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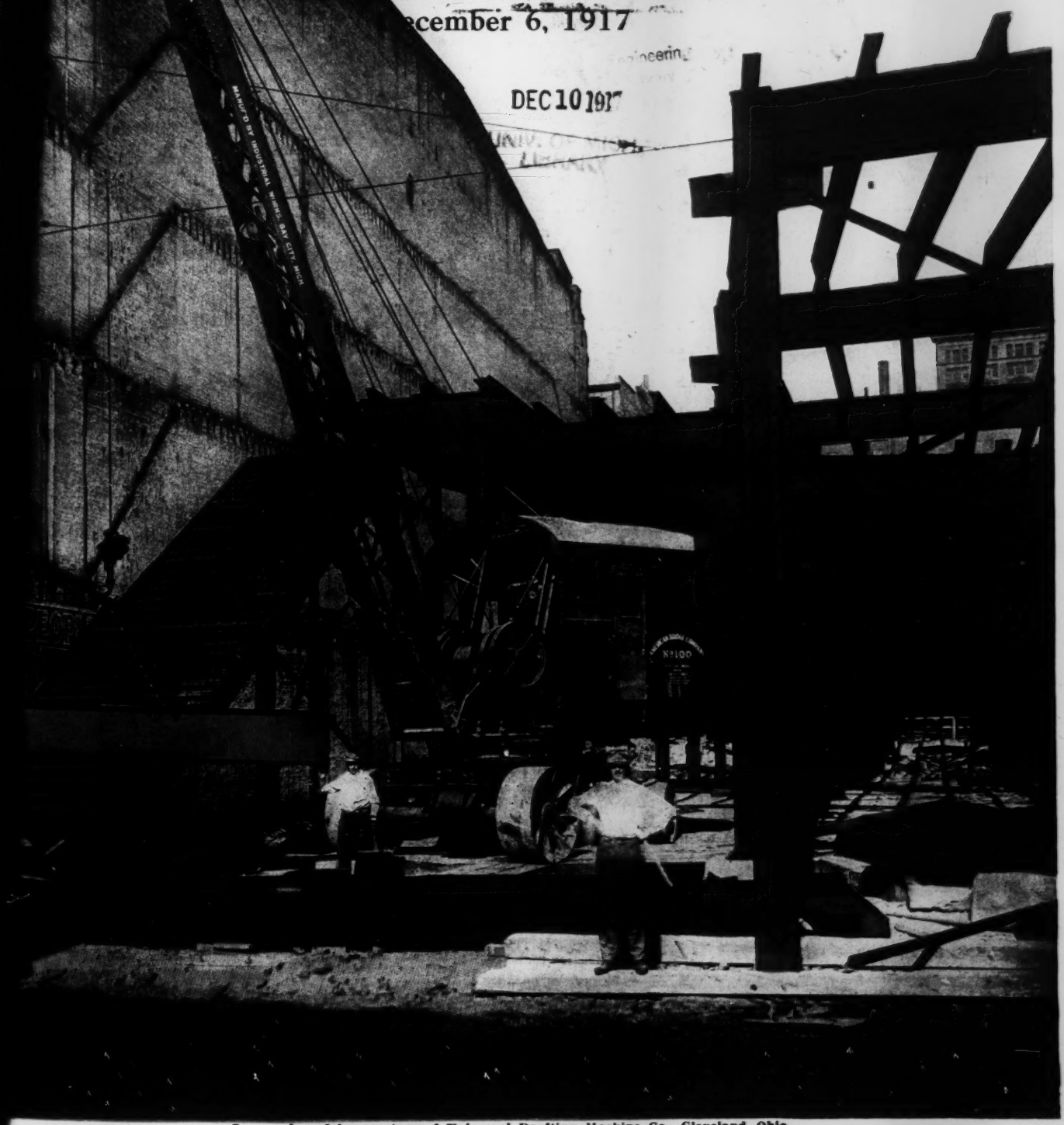

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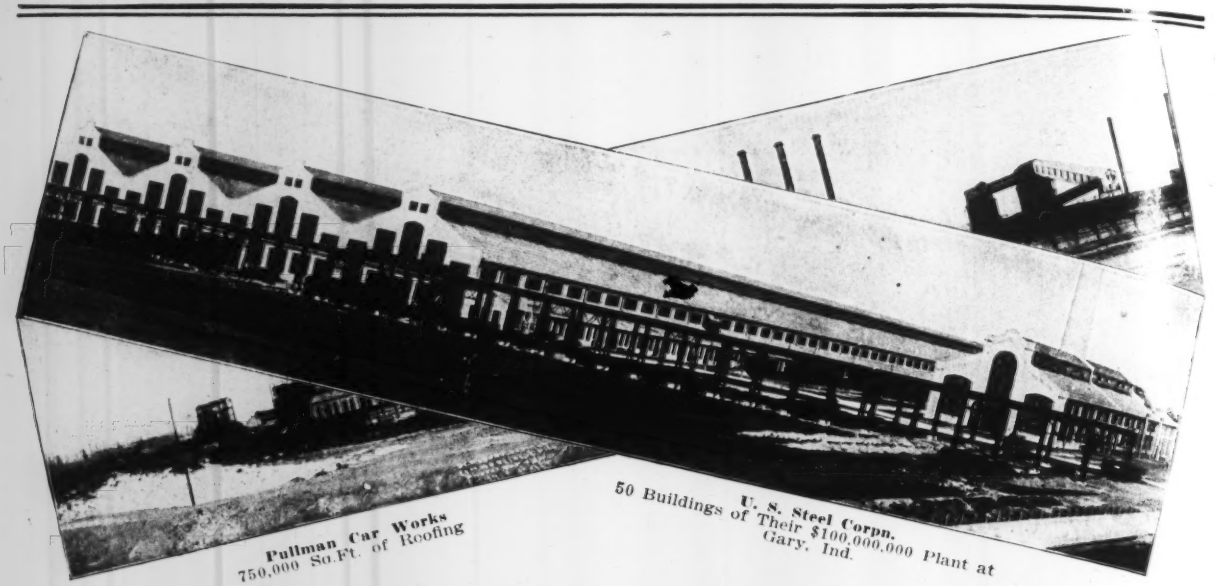

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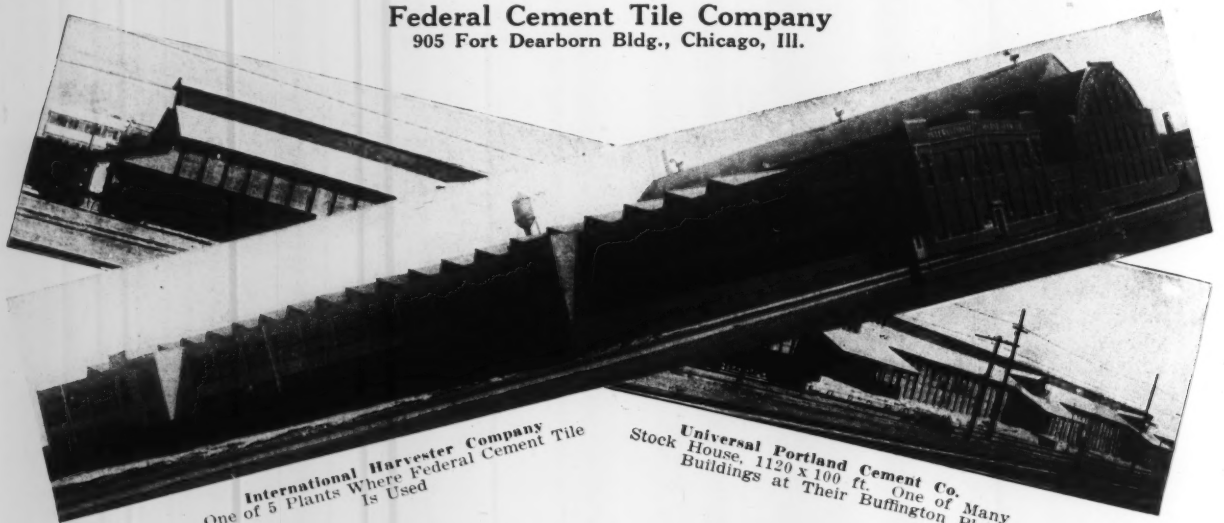

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Stock House, 1120 x 100 ft. One of Many Buildings at Their Buffington Plant

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What Is an Unessential?

THERE has been much talk about unessential industries. In fact, the expression will be found frequently in discussions in this journal. It seems reasonably easy to name some industries which can easily be dispensed with. Yet when one hears that certain strong and reasonable representations are being made that the manufacture of jewelry and musical instruments is an essential, one becomes less dogmatic, less sure of his ground. The basis on which it is claimed that jewelry and musical instruments are essentials is that there is a demand for them in foreign countries. If we can, in return for essential goods we are getting from Brazil, the Argentine, and Chili ship products, a favorable trade balance can be maintained. While the citation of this instance indicates how complex are the commercial problems raised by the war, it does not change the fact that some industries must expect curtailment. The big question is the determination of those industries.

The Task Which Confronts America

SPEAKING comparatively, what England has accomplished in the direction of unifying herself for the exhausting effort of war has been simple. A small country geographically, of less than half the population of the United States, possessed of well-developed railroads and manufactures, she has in addition the almost inestimable advantages of a nearly common blood and age-tried traditions. Subordinate to these factors, but of immense practical usefulness, is the almost complete unionization along business lines of her workmen in what are known in England as the "engineering industries." Contrast these conditions with the complex with which we are faced. Every item in the count is reversed to our disadvantage. Yet from this tangle of crossed racial tendencies and interwoven social ideals must be produced that singleness of purpose and unity of action which alone will make our true weight felt in this war being waged that "freedom shall not perish from the earth."

A Problem of Many Factors

IF HIGHWAYS are to be made of maximum service in the present transportation crisis, it will be necessary to meet a great number of problems. Some of these have already been discussed in these columns. A new one is brought up by a statement of the Beam Fletcher Corporation, published on page 1033 of last week's issue. The company says that it will be unprofitable for them to conduct trucking operations east of Pennsylvania after Jan 1 because of New Jersey's new motor vehicle law, reducing the speed of trucks to 10 miles per hour. To construct good roads, to arrange for the proper maintenance of those that can be used in war service, and then to make their use unprofitable by setting a foolishly low maximum speed limit is nothing short of absurd. Nevertheless, this is only one of the many difficult problems which the state highway departments and the Highways Transport Committee will have to meet. If they adopt the right attitude, these organizations, fortunately, will get all the support they need. They can solve the problem of making the highway a valuable adjunct of our transportation system. Courage and an adequate plan are the essentials.

A Momentous Session of Congress

HISTORIANS will have to accord a large place in their annals to the work of the last Congress. Large, however, as were its responsibilities, in some respects the problems that face the coming session are more important. Heavy taxes were levied at the last session, momentous increases authorized in our military and naval establishments, and, in general, the legal authority given to put the country on a war basis. Since those rushing days we have had some time for reflection. Those were the days for action. Necessarily, much was done without provision for the necessary coördination, and gaps are found here and there. This coördination, this readjustment, this filling of gaps, is the work of the new Congress. For example, one of the mighty problems is that of labor. The President intimated in his address to the American Federation of Labor at Buffalo recently that he had a solution or at least some plan in mind. Doubtless it will be put before this Congress. Except the declaration of war itself, it is the biggest piece of business of the year—how shall our labor be redistributed? how compensated? how mobilized and used so that we shall secure the tremendous production upon which the winning of the war is dependent?

Price Fixing Is Progressing

PRICE fixing by the Government for the products of industries essential to the war must soon enter a more comprehensive stage. If, as the Chamber of Commerce of the United States has said, price fixing is intended by the Government to: (1) Enable the Government and public to purchase at prices below the

market; (2) substitute for distribution controlled by prices a distribution based on the requirements of the war; and (3) prevent excessive profits on war contracts, and thus eliminate, among other things, a cause for discontent on the part of labor; then the measures so far adopted evidently have in view the immediate accomplishment only of the first object. It is seen that no basic classification of industries in the order of their necessity or usefulness to the conduct of the war has been attempted, priority orders being issued only on the merits of individual cases, and almost exclusively so far on direct Government work. Such a classification must be made before the second object, distribution by priority, can be obtained. It is plain that with the wide divergence in efficiency of methods and equipment between different units of the same industry some refund in taxes must be collected on war order profits if these, as well as prices, are to be kept low and made uniform. The existing revenue law hardly does this; and the more efficient plants, which produce the larger share of the total in lines where prices have been fixed, are actually making large profits under it. Therefore the accomplishment of the third object has evidently not yet been attempted.

Business men must not judge the success of price fixing yet. The Government has had to experiment and go slowly. For this it cannot be blamed. Moreover, the administration undoubtedly is planning steps for the accomplishment of the last two objects. This journal has shown that price fixing aiming only at the first object is deemed to failure, and the administration has given evidence that it is aware of this fact.

On the other hand, the complexity of the problem must not hold the Government's hand too long, lest disorder and discontent result which may well thwart its efforts. We must have a classification of industry as soon as a practicable one can be arrived at. It need not, and cannot be perfect, but if done as intelligently as the work so far accomplished it will be far better than the lack of classification which now obtains.

States Should Buy Road Materials in Bulk and Store Them for Next Year

CO-OPERATIVE buying of road material for the different counties in Iowa is to be tried next season. As outlined in *Engineering News-Record* of Aug. 30, p. 386, each county is to submit an estimate of its needs to a committee of the Association of County Supervisors which will ascertain all the sources of supply, the prices and the best points to which the materials can be sent for storage until needed. Large purchases will command lower prices, particularly as for shipper and the railroads. Tennessee has had in operation for a year a similar plan, which is even more advantageous for the contractor, because the state buys the materials outright and resells to the counties, while the Iowa committee has no such buying authority. This method or any other which will relieve the contractor from uncertainty as to getting materials will go a long way toward the receipt of reasonable bids, because hereafter a round sum is going to be added for transportation risk. Next summer every kind of traffic facility—motor trucks, freight cars on interurban railways, and barges on waterways—will be in great demand. If there is any late winter lull it should be taken advantage of.

As to the form of contract, every legitimate expedient that highway engineers can think of to get materials on the ground early should be recommended to their commissioners. The flexible partnership contract used so successfully this year in Massachusetts (see *Engineering News-Record*, July 26, page 172) is a laudable attempt to shift upon the state a portion of the risk of the unavoidable contingencies.

For some years past much material has been hauled an abnormal distance when good gravel and stone was obtainable near the work. The quarry nearest the job should have most careful consideration this year. It should be encouraged by being given plenty of time to fill orders. Equipment can then be put in shape and quarry owners can avoid the uncertainty occasioned by rush orders from contractors ready to begin work. Only separation of the materials from the contract makes the stock-pile method feasible, for the contractor can hardly finance the material man and take the chance of possible long time delay being imposed on all work by war exigencies.

In certain localities motor-truck haulage over frozen earth roads will be feasible and less expensive per ton-mile than over the mire of early spring. The middle of January will be none too late to let material contracts. As an example, Cook County, Illinois, authorized a $1,000,000 bond issue Nov. 6, for 48 miles of hard roads. Lake County, to the north, voted Oct. 30 for a $500,000 system. It may be too much to expect that the moneys from these issues will be available before spring, but if at all feasible the contracts for materials should be ready by the middle of winter. When both systems are complete, Chicago and Milwaukee will be interconnected. Much of this joint mileage can be served only by the railroads, but there are other vital parts of the systems in both counties that are within hauling distance of quarries and gravel pits.

No time apparently should be lost in getting the contracts for materials under way. Rulings and recommendations will undoubtedly come from the new Highways Transport Committee, but there is certainty that they will fit in with, rather than impede, the sort of planning here recommended.

Field Extensometer Promotes Safety and Economy

THE prominence recently given to measurements of dead-load stress, as reflected in this column last week, would fail of one important consequence if it did not help to lay further emphasis on service stress exploration. The value of the field extensometer has never received the practical recognition that it merits.

Some engineers have come to know by actual trial that increased safety or distinct economy may often be secured, at negligible expense, by intelligent use of the field extensometer. Measuring stresses in service is capable of revealing localized weaknesses not otherwise detectable; and just as readily can it give reassurance of ample safety in cases where calculation may lead to suspicion. A case in point was reported only a few weeks

ago (*Engineering News-Record* of Nov. 8, 1917, p. 883). The extensometer was applied to an old bridge whose margin of safety was in doubt, and it showed not only that the structure as a whole possesses a considerable margin of strength over the tax of modern loading, but also pointed out a serious local weakness which, once known, was easily remedied. Thus the instrument materially prolonged the life of an important bridge—and that, too, at a time when our national emergency gives multiplied value to every slight gain in service or durability. This single case carries a lesson well worth note.

There is nothing new in measuring live-load stresses by the strain gage; the knowledge of how to carry on such investigations goes back a generation or more. Yet, unfortunately, but little use has been made of it. Only few scattering instances of work like that mentioned above can be found in the literature of recent years. They would be supplemented by many others if the field extensometer became a tool of routine use by bridge engineers. Nothing but unfamiliarity with the instrument and failure to appreciate its possibilities is to be blamed.

Another case from actual practice may illuminate the subject further: An official bridge inspector recently came to feel that merely looking at a bridge did not tell him as much as he ought to know concerning its condition, and he began to carry a strain gage on his inspection trips—which he has since made a regular practice. In going over steel highway bridges he has found that most of them show unsatisfactory conditions in the hip hangers. The common four-angle hanger in many instances shows compression in its outer angles when load comes on the end panels; the inner angles show tension, but a greatly excessive tension. The explanation is ready to hand, of course, being found in eccentricity and floorbeam bending; but the important point is that we ordinarily shut our eyes entirely to such stress actions.

There is little chance to doubt that the safety of bridges in this particular inspector's bailiwick has been increased decidedly by his field extensometer measurements. Existing and future structures will share in the gain, through closer watch being kept on the weak hangers of existing bridges, and through improvement in design of new ones. Similar gain could be realized elsewhere by adopting the same means.

It is correct to speak of live-load stress calculations as being so accurate that verification by test may be dispensed with. But the statement confessedly leaves out of account not only all impact and secondary stresses but also various main stresses—those in stringers, laterals and the like. Viewing a bridge as a whole, the calculations fall short of answering all questions of importance, especially with respect to old bridges. The strain gage rounds out this incomplete knowledge.

The advantages to be secured through wider use of the strain gage in field inspection increase steadily as the demand for maximum safety and economy in our fixed structures becomes more urgent. Most emphatically does the present period, when economy is vital, direct attention to the opportunities which the instrument offers.

Priority Vs. Interfering with Ourselves

THE Government need not hesitate to go the limit in matters of priority. Indeed, the interests of the entire public, of investor and soldier, of manufacturer and workman, of business man and clerk, require it. A period of experimenting with the application of priority orders was doubtless essential to the understanding of the subject, to the intelligent application of the priority principle. This period, however, should now be drawing to a close. The indefinite pursuit of the practice of granting priority only on specific orders, or of lopping off from time to time in an inconsequential way some new unessential industry would not conform to the true principles of priority. Such practices would, in time, merely result in interference with ourselves in the main business of winning the war.

On the present, merely experimental, basis, some contractor finds its naval construction delayed for want of a few tons of special plates and shapes. A request for a priority order by the Navy Department is immediately granted. Then some big steel plant, working on dozens of munitions orders and ship schedules for ourselves and for our allies upsets the operation of two or three mills for a day or more to roll the special material mentioned in the priority order. This journal is informed that such cases not only occur under the present system, but that they are typical of its operation. Production of war necessities has been appreciably curtailed by such practices. Indeed, it is already demonstrated that in using such methods we are actually interfering with ourselves.

There need be no further hesitancy on the part of the administration in going to any length in its priority orders. The steel companies can be told that everything that goes into such and such schedules for merchant ships must be delivered to such and such builders, ahead of other business, that such and such shell rounds must be in the hands of such and such machine shops before similar steel is furnished anyone else; that material for certain war vessels must be turned out regardless of other work.

Let us issue priority orders in terms of ship schedules, munitions schedules, port-improvement schedules, and the like, instead of by the ton! In this way the equally vital schedules in the steel mills can be worked out to secure full-time production—a thing impossible under the present piecemeal, experimental system.

Full priority, which consists of giving an industry total requirements and full information as to time and place of delivery, with the stipulation that the order must be met regardless of other business, will also obviate difficulties that give rise to such child's talk as the proposition to take over and operate the oil industry, where the direct Government consumption, even according to the wildest estimates, will hardly reach three per cent. of the total output.

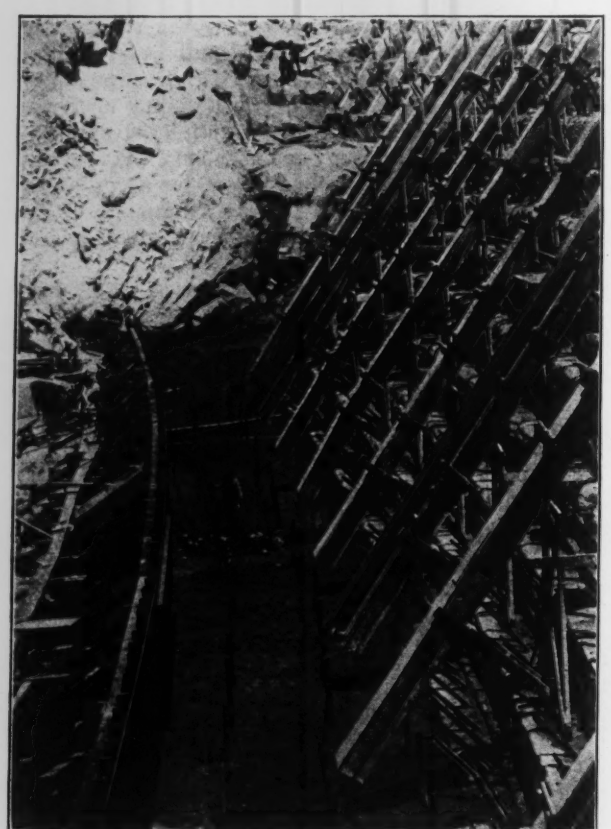
We should have done with half-way measures in this matter. The country will support the most rigid exercise of priority, applied on an inclusive basis. It cannot but chafe and continue to do less than its best if the present and now outgrown methods are persisted in.

How Construction Was Speeded Up by Doing Three Jobs at One Time

In Increasing the Height of Three Dams on Huntington Lake a Flexible System Was Used to Permit Concentration of Labor at Critical Points on the Work

THE Big Creek hydro-electric development of the Southern California Edison Co., the first part of which was completed by the Stone & Webster Construction Co. for the Pacific Light and Power Co. in 1912, stores water in Huntington Lake at an elevation of approximately 7000 ft. From this reservoir a penstock line supplies Power House 1 under a head of 2150 ft., and below this the water is again used in plant No. 2 under a head of 1900 ft. The energy which these plants generate is transmitted at 150,000 volts to Los Angeles, 242 miles away. A description of the general scheme of development appeared in the *Engineering Record* of Sept. 14, 1912, p. 286.

When the plants were put in service in 1913 it was intended to increase the height of the three dams 30 ft., at some later time, to add 40,000 acre-feet to the storage capacity of the reservoir. The decision to make these additions at once was reached in the fall of 1916, and it was decided that every effort would be made to finish the work during the open season of 1917. Authority to begin construction was received Apr. 20, 1917, and by May 1 crews were at work in 6 ft. of snow.



BOTTOMS OF 100-FOOT CHUTES ON DAM 3—NOTE RAIL BONDS

When the original construction was completed some of the equipment was retained, and this was quickly made available for use in making the additions. However, in order to pour the average of 1000 cu.yd. of concrete per day, which would be required in order to get in the total of 135,000 cu.yd. on schedule time, careful attention was given to the layout and arrangement of equipment. Considerable new equipment was purchased and a complete rearrangement of plants was effected wherever it was found that this would expedite the work.

Speed being the first consideration, electric drive was used wherever possible, and individual motors were provided in most cases to reduce the trouble and delay attendant upon moving parts. About 40 electric motors are in use on the job, ranging in size from 40 to 200 hp. A total of about 3000 hp. in electrical equipment is used during the full operation of the work.

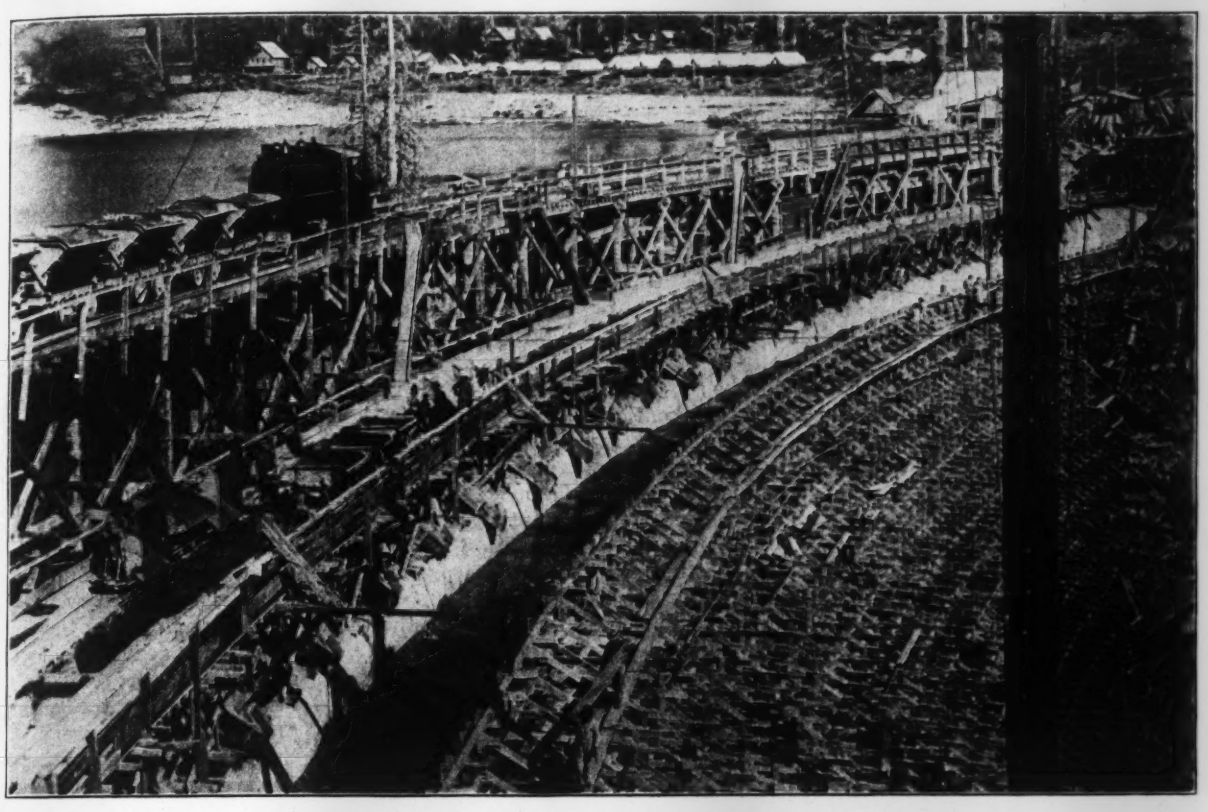
Standard-gage railroad tracks connect all three dams, and sand and gravel is handled in nothing smaller than 6-yd. dump cars, whether on main line or inclines. Cement is delivered direct to platforms from standard railway flat cars which have been brought up an incline from the railroad terminal 2000 ft. below. The location of the quarry, rock crusher and gravel washer, shown in the accompanying sketch, was chosen to afford the most direct delivery of material.

The work on each dam is laid out for two mixers, so two 24-in. gage concrete delivery tracks were put in on each dam. Thus trains from either end could deliver to any point on the dam independent of operations on the other track. By putting these tracks about 3 ft. apart and building between them a continuous line of hoppers, it is only necessary to run the cars to approximately the desired point and dump hastily.

The hoppers are 4 ft. long and the discharge from two hoppers is led into a single chute. When the work started the chutes on Dam 3 were 120 ft. long. Sections were sawed off as the work advanced until the top course was poured with only the short spouts leading from the hoppers. With this plan no time was lost in shifting chutes, and with the chutes only 16 ft. apart concrete was always delivered close enough to its ultimate destination.

The same system of continuous hoppers is in use on all three dams. However, different delivery levels are used on each dam, the concrete being poured up to the elevation of the top of the original dams and then a new trestle is built above this at the elevation of the new top of the dams.

It was most convenient to concentrate first on Dam 3 and two mixers were accordingly installed here. The first concrete was poured on June 5. In the meantime, work preparatory to the addition to be put on Dam 2 was undertaken and whenever the labor force was larger than needed on Dams 3 and 2, work was done on Dam



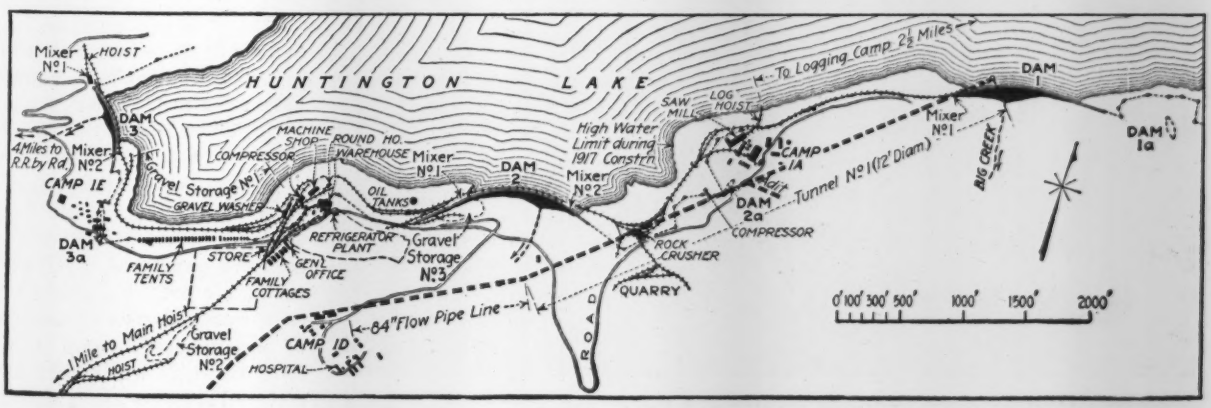
POURING ON DAM 3, LOOKING SOUTH, NEAR FINISH OF WORK

1. Under this system the work on Dam 3 was always kept ahead of that on Dam 2, which in its turn is further along than Dam 1.

By the time work on Dam 3 was well advanced pouring commenced on 2 with two 1½-yd. mixers, and work at this point was given a good start. On Aug. 3, the last concrete was poured on Dam 3, whereupon one of the two mixers from this dam was immediately set up at each of the other two dams, so that thereafter each structure was served by two mixers. The combined output of these four mixers under normal conditions (three of 1½-yd. and one of 1¼-yd. capacity) ranged from 1000 to 1700 cu.yd. per day for two 9-hour shifts, only two mixers being operated at a time.

In laying out the construction scheme it was anticipated that there would be occasional breakdowns of rock crushers, concrete mixers, or, in fact, any part of the system, and the sequence of operations was purposely arranged as stated, so that when shutdowns occurred in some one unit the entire system would not be paralyzed. For example, if one of the mixers at Dam 3 broke down, labor and material could be diverted at once to Dams 1 or 2. This obviates the necessity of reducing output of quarry, crusher and gravel washer, and the rate of progress on the entire project is much greater than if there were no flexibility in the system.

Being 2000 ft. above the railroad terminus and 300 miles from Los Angeles by rail made it highly desir-



CONSTRUCTION LAYOUT PLANNED TO SERVE ALL THREE DAMS WITHOUT DANGER OF TIE-UP BY BREAKDOWN AT ONE POINT

able to equip the camp to make its own emergent repairs. Not only has this been made a feature of the job, but the purpose has been to provide means for switching labor and materials in emergencies, so they can always be kept moving.

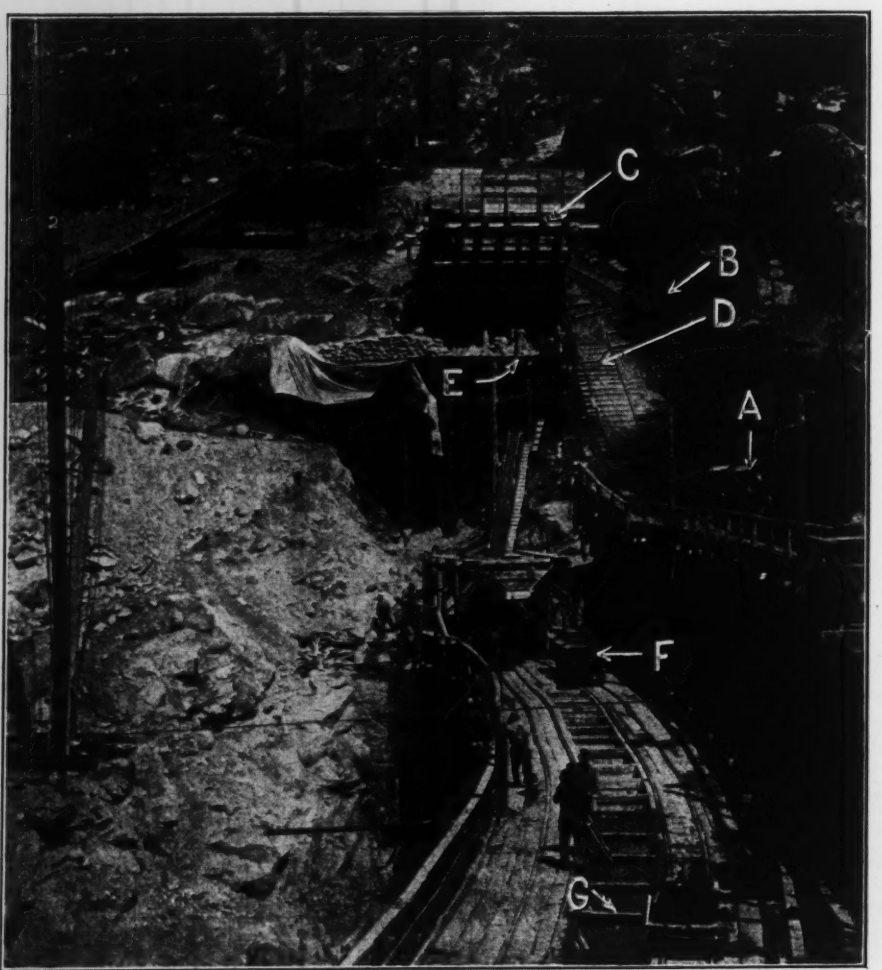
The gravel washer, which has a capacity of 500 cu.yd. per 10-hour day, is probably the most vulnerable point in the system, and in order to forestall shutting down of the work from breakage at this point storage for washed gravel was provided at the plant and at the dams. All screens and bucket conveyors are operated by individual motors. With this precaution and by giving special attention to the plant, it has been found possible to prevent any serious shutdowns.

Material which would not pass through the screens of the gravel washer was sent to a rock crusher beneath it. A rock-crushing plant with a capacity of 500 yd. in ten hours was also built, and a quarry was opened to provide rock for it. With the two separate plants it has never been necessary to stop pouring concrete for more than a few hours at a time.

The incline over which supplies are brought up from the rail terminus at Cascada consists of a single-track, standard-gage line, 6600 ft. long, with a maximum slope of 75%. Standard flat-cars with cable girdle and rigidly braced end built up at the rear are used for hauling freight up to the work. An electric hoist operating the incline consists of one 100-hp. and one 200-hp. electric motor. The ordinary capacity of the incline is twenty 20-ton carloads per day, but it was quite equal to bringing up a 40-ton locomotive that is now in use on the job.

Substantially all the lumber used on the work is turned out by the company's sawmill built on the lake, which has a capacity of 44,000 ft.-b.m. per day. A considerable quantity of good timber was cut in clearing the reservoir area, and this is supplemented by the cuttings of logging crews sent out along the shores of the lake. A very considerable quantity of drift has been picked up in the lake and cut into suitable lengths by an air-operated drag saw mounted on a barge at the sawmill boom. This scrap was made into rough lumber for miscellaneous use.

Anticipating probable price increases and delivery difficulties, at the outset of the work a $100,000 grocery order was placed, covering a complete list of all non-perishable supplies which it was calculated would be needed during the work. These are stored by the company and delivered at the camp in advance of requirement. During the normal progress of the work the three camps at Huntington Lake provide for a total of about 1500 men, all of which, except for about 100 who brought their families, are fed at company mess houses. The charge for board is 75c. per day.



GENERAL VIEW OF CONSTRUCTION EQUIPMENT ON NORTH END OF DAM NO. 3

A—6-yd. cars dumping sand and gravel into bunkers. B—6-yd. bottom-dump car from beneath bunkers. C—Bunkers over mixer. D—Standard-gage track for cement delivery. E—cement platform. F—Concrete delivery cars. G—Continuous hoppers.

For the married men were provided comfortable quarters, the majority of which are rented at $3 to $5 per month, including light and water. A complete line of general merchandise is carried at the company's store, the prices being cost as delivered at the camp in carload lots, plus 7½% for handling. Virtually all of the carpenters and other skilled laborers who brought families to the work have remained. The rate paid for common labor is $2.50 per 9-hour day.

Bunkhouses for the men are 16 x 30-ft. tents with 6-ft. walls, in each of which ten men are quartered, a cot and pad being provided gratis for each man. A special feature of each laborers' camp is the bath house, in which both hot and cold showers are installed. These are much used and appreciated. Sanitary precau-

tions have been made by leading all sewage to septic tanks and all cookhouse drains to cesspools. Garbage is kept in covered cans and removed twice daily. Under these conditions 50% of the men have remained since the work started and the average duration of service for all the men on the work is 60 days.

The work is being carried out for the Southern California Edison Co., with which the Pacific Light and Power Co. recently consolidated, under the direction of R. C. Starr, hydraulic engineer. William A. Whitmire is general foreman, and E. L. Kilry, master mechanic.

The South's Labor Problem and Its Effect on Road Work

Big Wages Demoralize Negro Workers—Convicts Used Effectively—Outlook Brightened by Greater Use of Machinery

By W. S. Keller
State Highway Engineer of Alabama

FOR the first time in its history the South has come face to face with the labor problem. Whether the problem is one that is temporary and only for the period of the war, or whether it will remain even after peace is declared, is speculative. During the winter of 1916-1917 thousands of negro laborers left the South for the North because of the scarcity of work. It is estimated that approximately one-third have returned.

Fully 80% of the laborers used in Alabama are negroes. Contractors who were fortunate to have good contracts were able to keep their forces intact, but others less fortunate were compelled to sell their outfits and go into other business. Within a period of six months, we went from one extreme to the other. War was declared, military camps were located and work of construction was started. Many old industrial plants, long idle, resumed work and those already at work began enlarging their plants, and unheard of prices are being paid for labor. The average negro laborer cannot stand prosperity. His money burns his pockets and he feels compelled to absent himself from his work for a sufficient length of time to permit the spending of it. Strange as it may seem, the higher the wage scale, the more demoralized becomes the labor.

Situation Which Confronts Contractors

The situation that confronts the road contractor is not the high price he has to pay for labor but the uncertainty of holding an adequate number of men on the job to keep within his contract prices and complete the work within the required time. If he could know that labor would be plentiful and constant, at a fixed price, he could make an intelligent and safe bid, but not knowing, or being unable to surmise, what changes may take place in thirty days, he is "up in the air." It is the belief of many that when Government camp work is completed the price of labor will become normal—at least, the laborer will seek work of a more permanent nature.

The situation is being met in many parts of the South by the use of convicts. Except where state convicts can be used to supplement the county convicts, the greater number of counties have not sufficient prisoners to make an economical working force. This is noticeably so since the "bone dry laws" became effective. That convicts can be economically and successfully used in highway work cannot be denied by those who are familiar with their use in such work. As in every other line of work, there are failures, but it does not take a Philadelphia lawyer to learn the cause of such failures.

Machinery Offers Relief

The use of improved machinery will have to be depended on also to relieve the labor situation. Here lies the source of much waste, however, unless the work to be done has been carefully planned by an engineer and unless a careful study of the most adaptable machinery is made before purchase. Unquestionably, the motor truck will henceforth play an important part in solving the problem. During the past year a number of Alabama counties began using trucks and trailers for construction and maintenance work. Montgomery County, with 450 miles of gravel roads, in using seven trucks, necessary grading machines and trailers, mainly for maintenance. Several of the other large counties are using to advantage such improved machinery.

Alabama plans the expenditure of a combined appropriation, Federal, state and county, of approximately $1,300,000. The last legislature of this state designated a system of state trunk roads on which all state appropriations must be spent unless the trunk roads in a county are completed to the satisfaction of the State Highway Department. In such event state money for that county may be used in building any other main-traveled thoroughfare. Federal aid may be used in like manner. As the trunk road system embraces approximately 3000 miles, one-half of which is now completed, it is safe to predict a completion of the entire system within a year or two. In planning the system, the roads were selected that connected the principal cities of the state and joined the main highways of adjoining states. Every county in the state is touched by one or more of these roads.

Most of the counties are poor and, as they have to bear the larger burden of the expense of construction and maintenance they cannot afford the higher types of road; but the locations of the roads are carefully made and, generally, concrete waterways are installed. When the state and counties grow to such extent that traffic is changed and increases so as to demand a better class of road, they will be well prepared with these features of permanency to make the change.

Standardized British Ships

The first of the standardized ships built under the specifications of the British government has completed its final test and has been put into commission as a cargo carrier. The trial test proved to be an unqualified success, although it was most exhaustive and comprehensive in its nature. The keel of this vessel, designed with the idea of providing a good type of cargo carrier in the shortest possible time, was laid in February, 1917, and by September, 1917, the first ship was fully loaded and ready to proceed on its first voyage. In the opinion of experts, the type is a very efficient cargo carrier and there should not be the slightest difficulty in selling such vessels to private owners after the war.

More Industries Testify to the Service of Good Roads and Motor Truck Haulage

Replies to "Engineering News-Record's" Inquiry Supplement Those Published in Last Week's Issue To Indicate the Effect on Manufactures of Priority Order No. 2, Forbidding Shipment of Road Materials

IN ADDITION to the statements in last week's issue, p. 1032, indicating the extent of industry's use of roads and motor trucks for the haulage of raw materials and finished products, the telegrams reprinted below have been received. Their significance lies chiefly in their relation to Priority Order No. 2, which forbids the shipment of road-building materials in open-top cars. If the order i continued in force the construction and maintenance of good roads, which are to a considerable extent serving as avenues of relief for the congestion of freight on the railroads, will be brought to a halt, except where local construction materials are available. The telegrams from manufacturers and motor truck users follow:

To relieve railroad congestion we are hauling all materials used in connection with making shoes between Whitman and Boston, Whitman and Milford and Milford and Boston. No bad roads. Hauling no war orders. Deliveries into Boston from the West our biggest handicap. REGAL SHOE CO.

Boston, Mass.

We are not using trucks on account of any congested condition, but we are hauling shoes and leather between Boston and Bridgewater. The bad roads are not interfering. The service of the railroads is very good, as we have trolley and freight. We are handling war orders. L. Q. WHITE SHOE CO.

Bridgewater, Mass.

We do not use trucks for relief of railroad congestion. Our principal item is coal received by boat.

Derby, Conn. DERBY GAS CO.

No to all questions yesterday's telegram.

Palmer, Mass. BOSTON DUCK CO.

Using truck for hauling silk between Paterson and New York. Bad roads interfering. Could not rely solely on railroads. Better highways would help. Highways are being repaired between here and New York. Not handling war orders. ORIENTAL SILK PRINTING CO.

Paterson, N. J.

I have been operating a 2½ and 3½-ton truck, hauling lumber from mills to sidings in Victoria, Va. In another month the roads will be so bad in that locality that I will have to abandon the use of trucks until spring, and rely on teams to do my hauling. The material which I am hauling is connected entirely with war industries. That is the reason I put on auto trucks while weather conditions were good. ALEX. MORTON.

Jersey City, N. J.

During last winter hauled gunbarrels, machine parts, and meats from Philadelphia to New York. Milk, Elmer, N. J. to Philadelphia. Road difficulty encountered on normally good stretches due to increased traffic and climatic conditions. Inability to use trucks in winter would only increase overhead charges on operation for the year. Better highways would reduce operating and maintenance costs, increase general utility of trucks, but snow removal is of utmost importance even with perfect roadbed. Considerable war material hauled Philadelphia tc New York for export.

Philadelphia, Penn. THE UNITED GAS IMP. CO.

We have a number of trucks, but they are all used for city deliveries of our product, paper, both in Philadelphia and New York. Did not think it was necessary to answer by wire. DILL & COLLINS CO.

Philadelphia, Penn.

We are not making sufficient deliveries over the roads to distant points to warrant our going into the question seriously. In regard to war order business, as a railroad and mill supply house, we have a very small portion of this class of orders.

STANDARD SUPPLY & EQUIPMENT CO.

Philadelphia, Penn.

Only using trucks between Baltimore and Washington where road is fine. C. D. KENNY CO.

Baltimore, Md.

We only use trucks from our branch houses to our main house. We do not use them for any outside hauling. HARRODSBURG ICE & PRODUCE CO.

Harrodsburg, Ky.

Answering your questions [see last week's issue, p. 1032] (1) Yes. (2) Wool and 16-ounces O D melton between our mill and Baltimore. (3) Yes. (4) Not serious at this time. (5) Yes, would allow us to load heavier. (6) Exclusively.

Oakland, Md. MELVILLE WOOLEN CO.

I handle butter, eggs and poultry and have houses in sixteen different towns. I operate three trucks at Versailles, one at Arcanum, one at Springfield, two at Covington, one at Troy, one at Xenia, two at Bryan and three at Dayton. Have been using trucks the last four or five years. My trucks are 1, 1½ and 2-ton trucks. The worst roads are those around Xenia. Am not hauling for any war industries. We use these trucks to go to the small country towns and gather up the produce. We also use them for hauling from one branch house to another, in order to make up car loads for shipment. Lots of the little places we make are not on a traction or railroad line. We also make some of the trips with horses and wagons. We use the tractions to ship eggs into Dayton from our various points, but most of our produce is shipped to New York City. Think you will find that a lot of trucking is being done where the distance isn't more than 20 miles. H. B. HOLE.

Greenville, Ohio.

We are not using trucks for country roads. Use railroads exclusively between towns. MORRIS & CO.

Chicago, Ill.

We and our customers have used trucks to limited extent to transport cement from our Buffington, Ind., plant to nearby points in Calumet industrial district in order

to avoid delays caused by railroad congestion and scarcity of freight cars. Poor condition highways has restricted this service. We are now building concrete roads in and leading to our plants in order to establish truck service to steel and other mills in Calumet district manufacturing war materials. Better highways undoubtedly would cause establishment in many sections, of truck service like that projected at Buffington and that between Cleveland and Akron and Goodyear truck service between Akron and Boston. We are handling some war business.

Chicago, Ill. UNIVERSAL PORTLAND CEMENT CO.

We are not operating trucks over highways to any great extent, but could relieve railroad congestion were we to do so. We are hauling for war industries. Motor truck could relieve congestion at this point. Roads within radius of 100 miles good for loads up to 3 tons. Most all business relying solely on railroads.

Dayton, Ohio. DAYTON TRANSFER CO.

This company is engaged in operating dump trucks, chiefly within the corporate limits of the City of Cleveland. We take contracts for excavating work or heavy hauling of bulk commodities, usually on the basis of so much per haul or per truck.

At the present time we have two trucks operating at Camp Sherman for a contractor for the Government on road work. We are, of course, constantly hampered by bad road conditions, but they are over such small areas that it would not be feasible to enumerate the places where we have had difficulty. The hauls which we make are not as a rule such as could not possibly be made by railroads.

We are not hauling directly for any war industries, although the two trucks we have in service at Chillicothe are working under a subcontractor for the Government in the construction of road work at Camp Sherman.

There is no doubt that if all the towns of any size within a radius of 50 miles of the City of Cleveland were connected with Cleveland by good highways, the truck transportation would be a substantial aid in relieving congestion. As conditions exist today, there is a great amount of freight transported between Akron and Cleveland by truck. This business has been created in a large measure by the unsatisfactory service the railroads give between these two points, and by reason of the fact that there is pavement the entire distance.

We operate six 5-ton Packard dump trucks and do not have flat bodies suitable for carrying package freight.

THE ARROW CARTAGE & STORAGE CO.

Cleveland, Ohio.

Only small amount truck operation on country highways due to freight congestion here as yet, but I and many other truck owners are giving this much thought trying to prepare for emergency. I operate five trucks—three 3-ton, two 2-ton units—hauling milk to dairy and stone for road building. Bad roads between here and Chicago, also Detroit, have prevented accepting hauls to these places on offer. Have had several inquiries for war material. My regular clients cannot use railroads only partially and congestion would only mean longer hauls. Road building at a standstill here due to lack of cars for any purpose except coal. I am not hauling for any war industry as yet. Thoroughly believe trucks and better highways would or can be made to relieve railroad congestion. ARTHUR G. WAY.

Toledo, Ohio.

We believe in good roads. Common brick, one of the low grade commodities, not benefitted. Have no war orders. NATIONAL BRICK CO.

Chicago, Ill.

It is my opinion that the roads around Peoria need to be worked after each rain with a drag of some kind. I do a great deal of cross-country hauling when the roads are in any condition and could do more if the roads, which are mostly dirt, were well drained and dragged immediately after each rain. I also find that where they have had a coat of oil that they are always better than those that have not been oiled. I operate one 3½-ton truck but think about a 2-ton truck with a wide tire behind would be a very good size to use for the cross-country haul. My clients would be somewhat delayed if they had to rely upon railroads at the present time. I have not been called upon to haul for any of the war industries but with good highways the motor truck could be utilized to relieve the railroad congestion.

Peoria, Ill. W. T. ROGERS.

We are using one 2½-ton truck and one 1-ton truck operating between Grand View and Rockport and between Grand View and Crisney delivering flour and feed to these points and bringing wheat back to mill on return trip. Roads between Grand View and Crisney are dirt and now impassible on account of mud. Road to Rockport improved and trucks make regular trips. These trucks are operated as matter of convenience on account of quick delivery being required. Better highways would be of great value. We handle no war orders at present. CADICK MILLING CO.

Grand View, Ind.

We occasionally do long distance hauling—very little recently. Have five 5-ton Pierce-Arrows; all our trucks have been occupied continually Camp Taylor past five months until two weeks ago. Roads fine within radius 30 miles Louisville. Cannot answer regarding clients' business. Not hauling for war industries. Trucks and highways can help relieve railroad congestion very materially at higher rates than railroads account higher operation costs. SCHROER TRANSPORTATION CO.

Louisville, Ky.

We operate one 2-ton, one 4-ton and two 5-ton trucks over country highways between Tonopah and Manhattan. No railroad between above towns. We help to some extent to relieve railroad congestion. At certain seasons of the year poor roads interfere with our hauling business. The business of our clients would cease to be if they had to rely solely on railroads. We do not haul for any war industries. Trucks and highways can relieve railroad congestion to a very noted extent.

Reno, Nevada. TONOPAH TRUCKING CO.

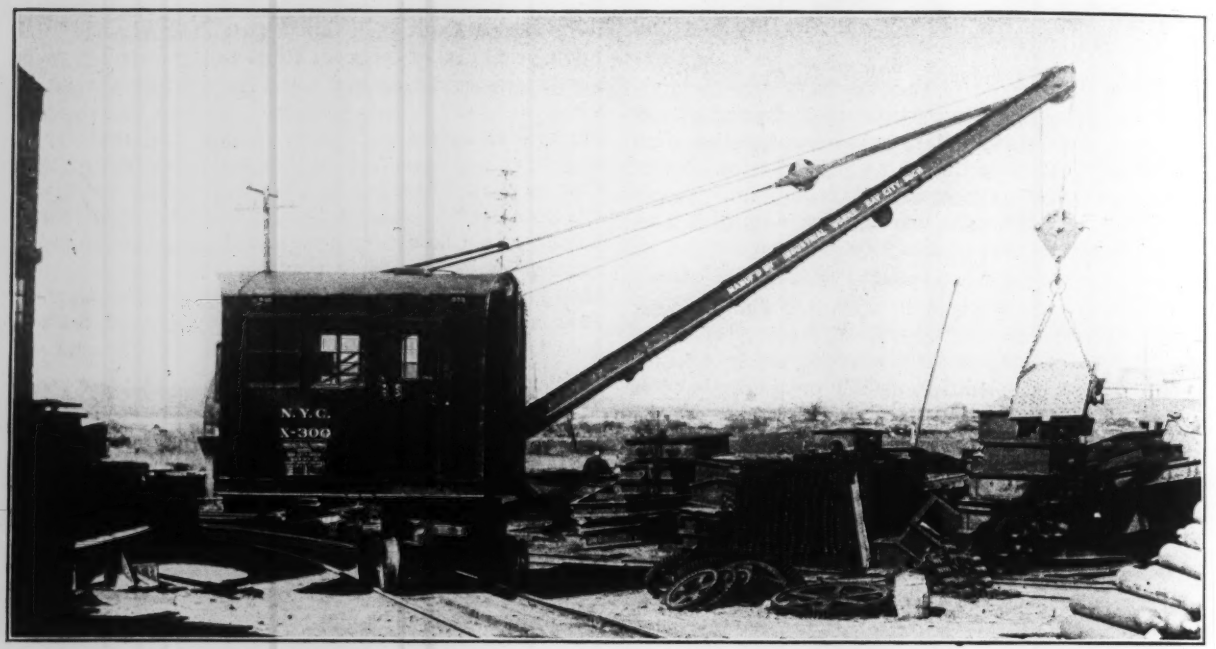
More Money for Electricity Than Railroads

California's electric light and power companies expended more for extensions and improvements than did the steam railroads of the state during the four years ending with 1916, according to a report of the California Railroad Commission recently issued.

Locomotive Crane Sprang from Small Beginnings

Grab-Bucket and Development of Multiple Uses Open Up Wide Fields to Tool Now Indispensable Alike to Construction Work and Industrial Plants—Three Different Types of Power Common

By James Shearer
Advertising Manager, Industrial Works, Bay City, Mich.

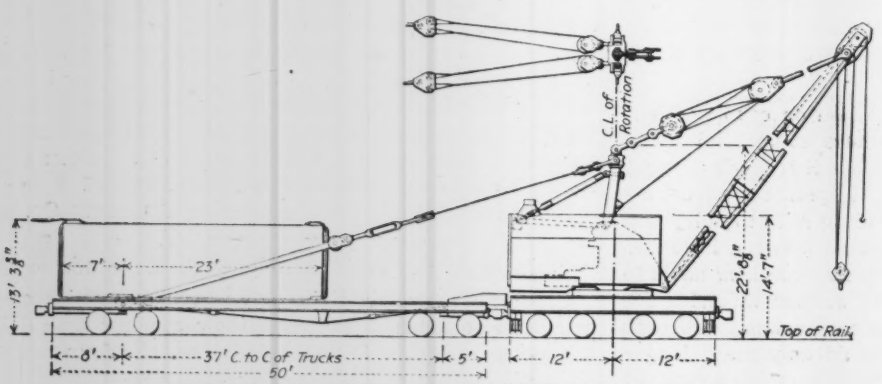


GASOLINE DRIVE PROVING VALUABLE FOR INTERMITTENT SERVICE IN RAILROAD AND INDUSTRIAL YARDS

IT IS a long way from the little iron crane of the early eighties with its maximum load of three tons at 14 ft. radius, to the versatile crane of today that handles a steel girder 130 ft. in the air or swings a 62-ton concrete block into place with ease.

The early portable cranes were simple jib cranes on rotating platforms mounted on four-wheel cast-iron cars, and were not self-propelling. They were intended for hoisting alone with a hook or sling, and it was not until 1899 that the use of a self-filling bucket became at all common. No other innovation has added so much to the value of locomotive cranes as this. The grab-bucket of the now popular clamshell type opened up to the crane the whole field of the handling of bulk material. The materials now handled range from coal and ore to oyster shells and sugar beets, and crane capacities range from small yardage to that of a modern crane and grab-bucket which recently loaded 4000 tons of ore tailings in 7½ hours.

With the perfecting of electric lifting magnets their adaptability to use on locomotive cranes for handling steel and iron was apparent. It was soon found that the greatest success was attained when the generator which furnished current to the magnet was mounted on the crane, making a self-contained unit entirely independent of any outside source of power. Such cranes have handled several hundred tons of material a day with savings of as much as 30 cents a ton.



A COMBINATION CRANE AND DERRICK CAR IS ONE OF THE LATEST DEVELOPMENTS

In many cases a locomotive crane can easily be converted into an entirely different type of machine, by using certain special attachments. With a properly constructed boom and the addition of a dipper arm and

bucket the crane becomes a steam shovel. A Western lumber company used such a crane-steam shovel in building a logging road and reported making a 13-ft. cut at ¼ the cost of previous methods. Similarly, by the addition of piledriver leads to the boom, the crane is converted into a piledriver that will do excellent work within its capacities. Two machines are thus available at little more than the cost of one, a feature appreciated more each year by railroads and contractors. Another type of combination crane is used for drag-line scraper work in addition to its regular work. Jas. O. Heyworth used a crane in this way on part of his contract for the Chicago Drainage Canal.

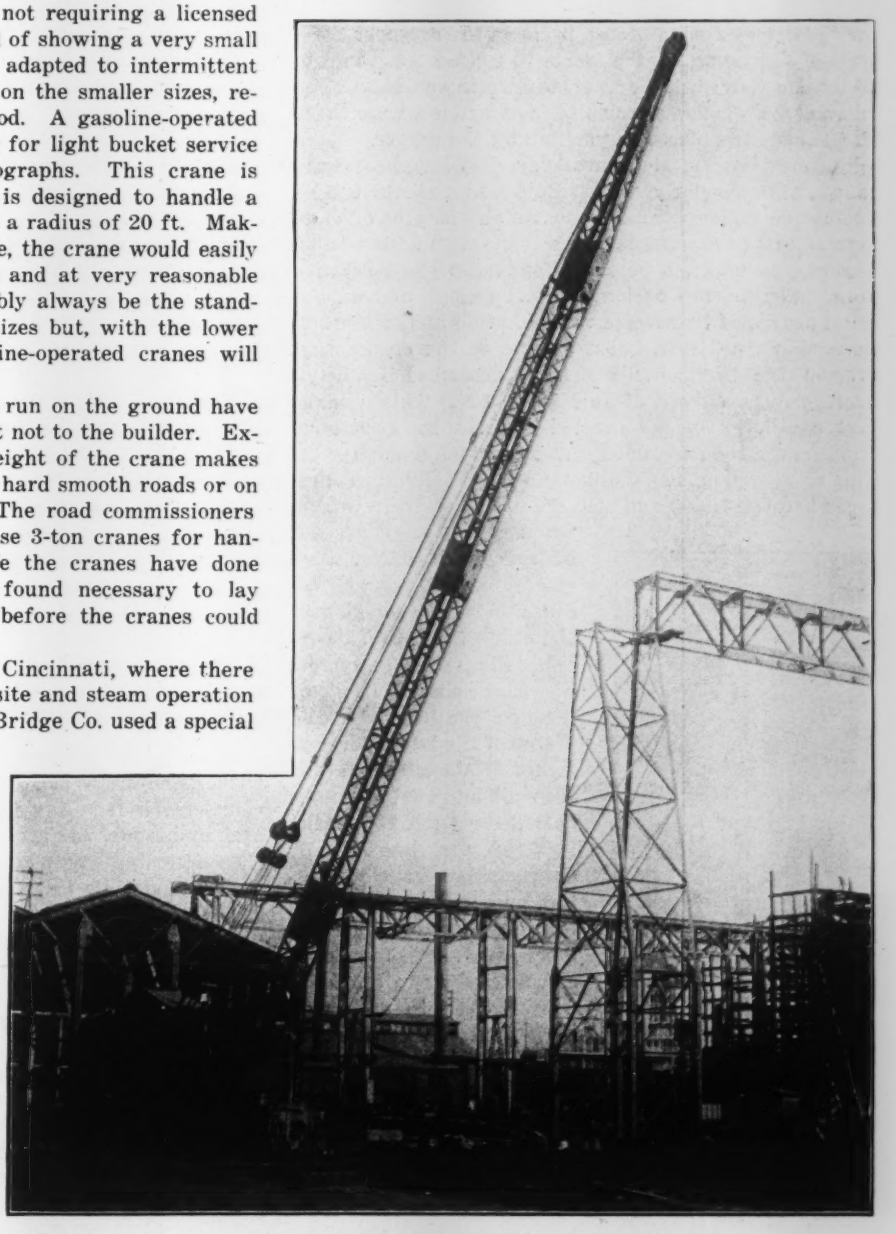
On account of the increased use of gas engines, it is only natural that attention should be given to their employment as motive power for locomotive cranes. Such cranes have the advantages of not requiring a licensed engineer, of making no dirt and of showing a very small fuel cost. They are especially adapted to intermittent service. While used now only on the smaller sizes, results, in general, have been good. A gasoline-operated crane for general yard work or for light bucket service is shown in one of the photographs. This crane is driven by a 30-hp. motor and is designed to handle a ¾-yd. grab-bucket full of coal at a radius of 20 ft. Making two complete trips a minute, the crane would easily handle a ton of coal a minute and at very reasonable cost. Steam cranes will probably always be the standard, especially for the larger sizes but, with the lower initial cost and upkeep, gasoline-operated cranes will force a way for themselves.

Cranes on traction wheels to run on the ground have long appealed to the layman but not to the builder. Experience has shown that the weight of the crane makes propelling impossible except on hard smooth roads or on planking laid on the ground. The road commissioners of Wayne County, Michigan, use 3-ton cranes for handling road material and, while the cranes have done much excellent work, it was found necessary to lay planking even on good roads before the cranes could propel themselves.

For special erection work in Cincinnati, where there were no railroad tracks at the site and steam operation was undesirable, the American Bridge Co. used a special 12-ton gasoline-operated crane running on very broad traction wheels. This crane, shown on p. 1050, had a 70-hp. motor and a capacity at 40 ft. of three tons. Special provision was made for propelling, with a differential on the driving axle, both hand and power steering, and a choice of speed of 1½ or 3½ miles per hour. It propelled itself satisfactorily to its work over city pavements (after a bond protecting the city against damage was furnished) but required planking on ordinary ground in spite of the fact that it had power enough to spin the wheels.

It is entirely possible that some type of caterpillar traction, such as has proved successful for the famous tanks and big guns in Europe, may yet be developed for locomotive crane service. Until then, the place for a self-propelling crane will be on rails, not on the ground.

Erection cranes, so called, are large-capacity locomotive cranes designed primarily for the efficient placing of the steel members of bridges, buildings or other structures. Their development, keeping pace with the advanced plans of bridge building engineers, has contributed greatly to the successful accomplishment of recent erection feats. While not having the capacity at long radius straight ahead possessed by derrick cars, they have a far greater ease of maneuvering and the obvious advantage of 360° rotation. Nominally rated as 60-ton cranes, in capacity they come between locomotive

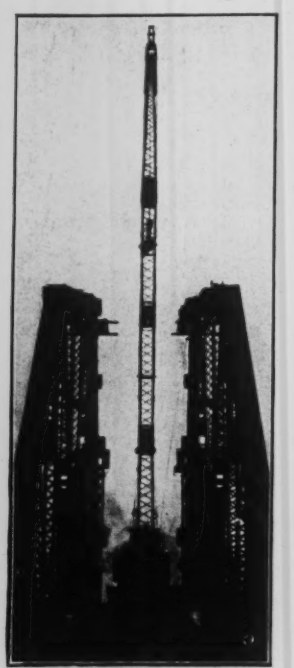


IN THE SHIPYARD, TOO, THE LONG BOOM IS AN ADVANTAGE—THIS ONE IS 105 FEET

cranes and wrecking cranes, but compared with the latter they are found to have greatly increased speed, relatively greater power and greater adaptability to different kinds of work. To facilitate operation, air-operated clutches are provided, as well as a slewing motion of the selective type with a slow speed for heavy loads and a fast speed for light work. In addition to the boom-hoist motion, they have four independent hoisting motions—the main and auxiliary hoists and two winch heads—any one of which may be used for hoisting or holding lines. An air compressor furnishes air for pneumatic tools.

A recent case shows how the use of these large-capacity cranes has influenced steel construction. For a large building at Gary the Indiana Steel Co. used massive built-up columns weighing 46 tons each, to support girders having a weight of 132 tons. Without the cranes, it would have been a problem to transport these unwieldy members to the work, to unload them and to place them. With the cranes, the work was easy. The columns and girders were shipped assembled, were lifted off the cars and placed in position by the cranes.

With the large capacity available, very long booms can be used, particularly when height is the chief aim. Booms 100 ft. long are not unusual and lengths of more than 130 ft. have been used. A crane with such a boom becomes, in effect, a portable four-hoist gin pole with great independence of longitudinal motion and an unusual degree of transverse motion. One of the illustrations shows a 110-ft. boom on one of the cranes that erected the Steubenville bridge, described in *Engineering News-Record* of July 19, p. 104. This was the first cantilever bridge erected entirely by locomotive cranes, even the suspended center span being so erected. This work was made possible, because the erecting engineers had the vision and courage to use on their work a tool that, in smaller sizes, had proved itself on work of an allied nature, and because of the coöperation of the crane builder in developing his crane to meet the essential conditions of modern erection service.



CRANE WITH 110-FOOT BOOM AT SCIOTOVILLE, OHIO

One of the latest developments is along the line of economizing the plant required for a job. It was the idea of the late H. A. Greene, when division erection manager of the American Bridge Co., that an erection crane could be so constructed as to be easily convertible into a derrick car. The one machine would then have the advantage of a derrick car for long reaches straight ahead, and also those of a crane for side lifts or high lifts at shorter radius. In coöperation with the builders, a machine was developed consisting of a 60-ton capacity erection crane with a high-arch A frame anchored to a tender car behind the crane. The backward pull on the boom-hoist system is transmitted through the anchorage to the weighted tender car, which is especially built to resist the 225-ton horizontal component of this pull. The drawing shows a side elevation of this combination erection crane, for which a patent has recently ben issued. When operating as a derrick car with a 60-ft. boom, a load of 60 tons can be handled at any radius from 16 to 56 ft. straight ahead and the crane will propel itself with the load. To make side lifts as an ordinary locomotive crane, the short diagonal from the top of the arch to the rear of the crane is tightened, and the rear anchor to the tender car loosened. The crane can then work and slew in almost a complete circle. Any length boom can be used if the arch and tender car attachments are removed, the crane then becoming a standard erecting crane.

WITHOUT MODERN CRANES SUCH HEAVY STEEL COULD NOT BE SET

Two unusually large locomotive-type cranes have recently been used on notable work where the cranes made possible a distinct advance in construction practice. In each case, in planning the work, the builders decided that if a crane could be adapted to handle the required load at the necessary radius, a departure from the usual methods would be justified by the results. Again it was a case of broad-gage engineers deciding that large locomotive cranes could do exceedingly heavy work just as satisfactorily as smaller cranes had done lighter work. Locomotive cranes were promoted, as it were, to an advanced position.

At Halifax, concrete piers had to be built for an ocean terminal in 45 ft. of water. By using 160-ton wrecking cranes with 45-ft. booms to place immense concrete

blocks, the cost and difficulty of building a cofferdam, and of unwatering, maintaining and removing it, were avoided. There were 3300 of these blocks, most of them 31 x 22 x 4 ft., weighing 62½ tons. With their elaborate lifting tackle they made a load for a crane of 70½ tons. This load was handled at 33-ft. radius by a self-propelling crane having air-operated clutches to facilitate operation. Both *Engineering News* and *Engineering Record* have described the most unusual methods employed at the Halifax terminal.

The other case in which a large wrecking crane was adapted for use as a locomotive crane was in the building of the Metropolis bridge. This was an erection job of unprecedented size which required the placing of large, unwieldy members high above the bridge floor. Conventional construction methods would have called for the building of an expensive special traveler. A departure, however, from the usual methods, with proper planning of the details, allowed a simple tool to be used with unusual success. The solution was big locomotive cranes and falsework.

For the erection of the 720-ft. span, the crane surpassed, in its weight and length of boom, any previously used for heavy erection work. This crane had a boom 130 ft. long and capacity such that, when operating at a radius of 30 ft., it could pick up a 50-ton member, swing around with it and place it in position high in the air as desired. With a 60-ft. boom it had a capacity of 94 tons at 30 ft. and 43 tons at 60 ft. Unusual stability was required, as well as ease and sensitiveness of control. The crane was a 150-ton wrecking crane with an outrigger system for stability that could be extended to 12½ ft. at the center and 8 ft. 9 in. at the ends. Air-operated clutches and two-speed slewing facilitated accurate control. An advantage of these cranes is that when no longer needed for special work they can be equipped with shorter booms and sold to railroads for use as wreckers.

It is evident that the development of locomotive cranes must virtually parallel the development of the methods of using them. In some cases the crane builder sees the need for a new type of machine and demonstrates its value to a purchaser. In the majority of cases, however, it is the prospective user who starts things. If he had a crane that would perform certain operations in a specified way, he could make one machine do the work of two or could replace twenty men or could adopt new methods. As he keeps abreast of engineering practice as it advances, the chief function of the crane builder on development is to reproduce in steel and iron the selected ideas of those restless souls who are always seeking a better way of doing their work. The builders best able to do this have added most to the value of the locomotive crane.

Prof. Whipple Tells of Chinese Floods

AT A recent meeting of the Boston Society of Civil Engineers Prof. G. C. Whipple, president of the society, described his visit to Russia as a member of the American Red Cross Mission. On the return he passed through China and Japan in time to see the great floods which occurred there. The past summer saw several floods in northern China but the worst one occurred in September. This flood covered a large part of the city of Tientsin, and if certain railroad embankments had not been cut in such a way as to release the flood waters the entire city would have been submerged. As it was, approximately 200 were drowned at Tientsin. The cutting of the railroad embankment caused the flooding of 15,000 square miles of land to an average depth of 4 ft., driving at least a million persons from their homes.

The accompanying photograph was taken in Tientsin during Prof. Whipple's visit. As a member of the Red Cross he investigated this flood and the need of relief, and the American Red Cross has already sent a considerable sum of money for the care of the refugees. Its distribution has been entrusted to Roger Greene, and Dr. S. H. Chuan, the surgeon-general of the Chinese army and a former student of Professor Whipple's and Z. Z. Chow, a graduate of the Massachusetts Institute of Technology, are active in the relief work.

In Japan the Red Cross party reached Osaka just in time to witness the flood caused by the greatest typhoon which has visited Japan in fifty years. Here again it was necessary to choose between flooding the city with its industrial establishments and costly engineering works, and an area of farm land. The officials choose the latter alternative and cut the railroad embankments and dikes in order to release the flood waters. In Tokyo the typhoon destroyed buildings, uprooted trees throughout the city and did much damage to life and property.

THE STREETS OF TIENTSIN DURING THE GREAT FLOODS OF SEPTEMBER

Undercrossing Wing Wall Designed To Limit Base Pressure

Box Culvert Forms Main Tunnel and Wing Walls and Floors Built of Slabs Cut To Permit Earth to Tail Through

IN THE undercrossing for the Donner Steel Co., at Buffalo, on the Delaware, Lackawanna & Western R.R., a special type of reinforced-concrete structure was designed to effect economies and to make the base pressure as low as possible. The details of the structure and a perspective showing the general layout are given herewith.

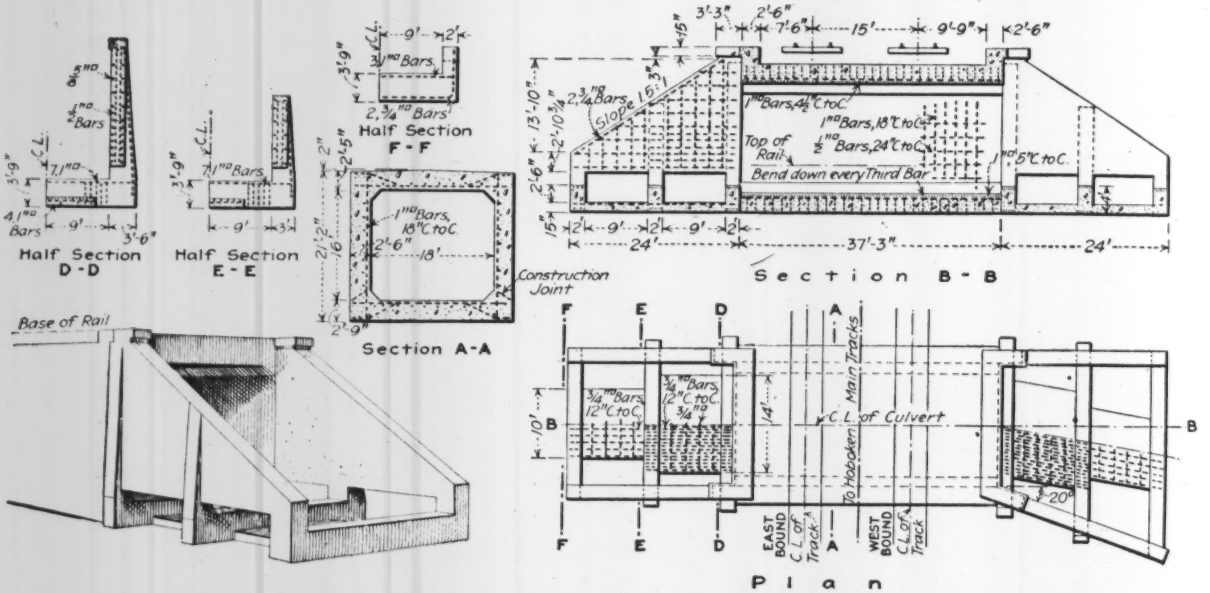
The main crossing is a box culvert carrying the undercrossing, which contains a narrow-gage industrial track. This culvert is 18 ft. wide inside and 15 ft. high, and extends across a distance of 20 ft., which is sufficient to carry the two-track main line railroad above. The earth fill is held by special wing walls separated from the culvert by construction joints, so that any uneven settlement will not cause cracking at the juncture of the box with the wings. These walls are alike in detail, except that on one side a steel approach of 20° is made to take care of some necessity in the yard layout. The other side walls are square with the culvert.

The wing walls are of special detail, designed the first time for this particular structure. They consist of parallel walls sloped on top to meet the fill, and resting on three transverse girders, which in turn foot on floor slabs in the space between the walls. Counterforts are provided with steel on the outside to resist properly the earth pressure on the vertical slabs and frame into the transverse girders. The bottom of the side walls are cut away to allow earth to tail down between the walls. The floor slabs do not extend the whole width between walls, being proportioned in width only sufficient to carry their load with a safe pressure on the bottom. The side walls are in effect slabs spanning between the counterforts.

Earth pressure is thus transmitted to the counterforts by slab action, thence to the transverse girders, and from them to the floor slabs. Assuming the vertical load of the narrow-gage track as being transmitted directly, and assuming, further, that 50% of the horizontal outside earth fill is transmitted as the vertical component to the footing on account of friction on the side walls, the pressure on the floor slab is ½ ton per sq.ft. for the section nearest the culvert, and ¾ ton per sq.ft. for the section away from the culvert. Under the box culvert the maximum unit load is 1½ tons, the limiting value of the ground.

A reinforced-concrete structure of this type was selected because gravity abutments would have required a longer span of falsework carrying the traffic over the construction, and also because of the light foundation pressures allowed by this special design. Gravity sections, especially in the wing walls, would have required piles with a cut-off about 4 ft. deeper than the base of the reinforced-concrete type, and the pressures without the piles would have been excessive. The soil conditions made it necessary to limit the allowable earth pressure to 1½ tons per sq.ft. Other requirements included a clear width of 18 ft., an overhead clearance of 12 ft. above top of rail, for the narrow-gage industrial track which runs through the box, and a concentrated loading on each track distributed over 13-ft. width laterally. The unit stresses were proportioned to provide for Cooper's E-60 live load on the double-track railroad above, with impact according to the formula of the Lackawanna Railroad.

The opening under the vertical slab of the wing wall lessens the horizontal earth pressure. The opening in the horizontal slab between the wing walls, while only of a width necessary to take care of the load, was left also for purposes of construction in that the entire wall could be built, horizontal and vertical slabs to-



NEW TYPE OF UNDERCROSSING PERMITS EARTH FILL TO TAIL THROUGH WING WALLS

gether, in one operation. This precluded the necessity of a construction joint between the base and vertical wall, such as is usual in reinforced-concrete wall construction. This joint in the usual type of wall occurs at a point of maximum moment in the counterforts, making possible the deterioration of steel at this particular point.

The design was made by the engineering department of the Delaware, Lackawanna & Western R.R., under the general supervision of G. J. Ray, chief engineer, and was directly in charge of A. B. Cohen, concrete engineer. The construction was carried out by railroad forces.

Concrete Frame of Building Carries Wood Floor

This Arrangement Substituted for Steel Girders and Cast Columns—Special Construction of Columns and Girders

A REINFORCED-CONCRETE frame carrying timber joists and floors gave the most economical construction for a four-story warehouse of the George Rasmussen Co. at 130 N. Jefferson St., Chicago. The 40 x 80-ft. building has just been completed. The original plan called for cast-iron columns and steel girders, but it was found that a distinct advantage could be obtained by substituting reinforced concrete for the frame, retaining wood-joist floors.

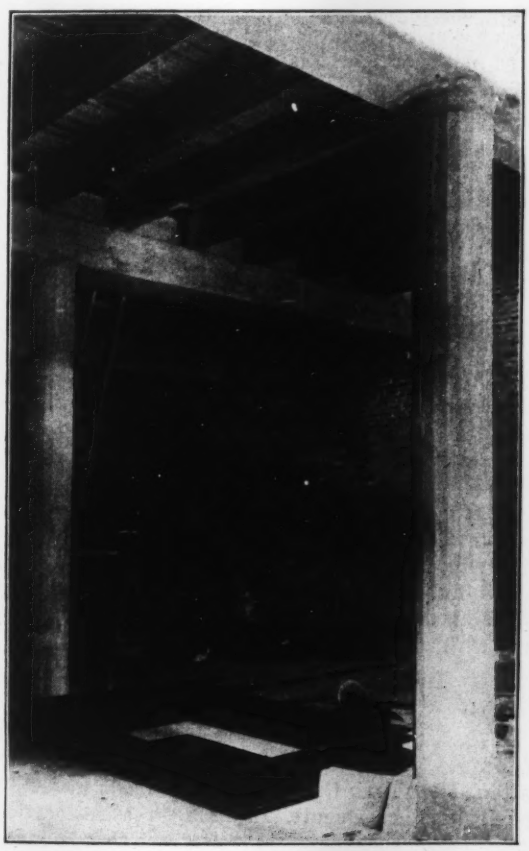


FIG. 1. TIMBER JOIST AND FLOOR ON CONCRETE GIRDERS IN RASMUSSEN WAREHOUSE

FIG. 2. GIRDER AND COLUMN CONCRETED IN ONE OPERATION; JOIST AND FLOOR IN PLACE

The layout made the floor panel 13 ft. 2 in. x 20 ft., and this column spacing was retained. It was necessary also to observe the originally fixed clearance limit, which allowed for 15-in. I-beams under the floor joists. The final result is illustrated by the view, Fig. 1. The original and final designs are contrasted in the sketch, Fig. 3.

The building was designed for a live load of 240 lb. per sq.ft. of floor. The floor construction consists of 8 x 12-in. wood joists 34 in. on centers, carrying a plank under-floor and maple wearing surface. The girders, spanning 20 ft., were to be two 15-in. I-beams resting on the caps of cast-iron columns. For the reinforced-concrete girders, an additional 12-in. depth was obtained by carrying the girder up to the top of the joists, as shown in the sketch.

The columns are of the concrete-hooped cast-iron section originated several years ago by F. von Emperger, of Vienna, Austria. The type is being applied to several buildings up to 10 or 12 stories high by L. J. Mensch, consulting engineer and contractor, Chicago. In the Rasmussen warehouse the columns have an over-all diameter of 16 in. in the lower stories and 12 in. in the upper stories.

The steel spiral hooping in the concrete which surrounds the cast-iron column core is proportioned as 1% of the total volume of the column. The concrete shell and the filling of the cast-iron core are 1:1:2, while the material of the girders, which under ordinary circumstances would be 1:2:4, is in this case made 1:1½:3 on account of the high compressive stresses resulting from the shallow depth of the girders.

One of the girder forms and a column, ready for concreting, are shown in the view, Fig. 2. The cast-iron column core projects up through the form to a

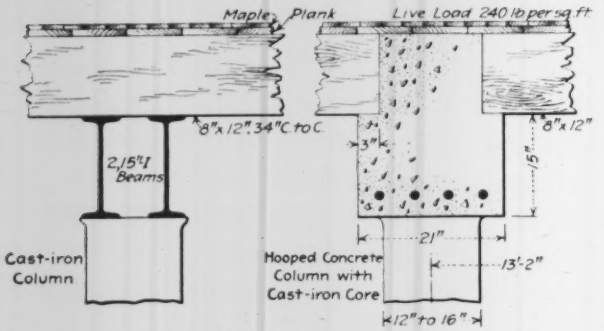


FIG. 3. ORIGINAL AND FINAL DESIGNS

point about 2 ft. above the floor. The method of construction adopted was to frame the permanent timber work of the entire floor, supporting it on the sides of the girder forms, which latter were supported by three pairs of 4 x 4s; and to proceed with concreting in one operation for girders and columns of the story. The over-run of the floor joists which can be seen in Fig. 2, was unintentional but was not considered objectionable.

The design of the columns was based, under permit from the Chicago Building Department, on a compression of 11,200 lb. per sq.in. in the cast iron and 1120 lb. per sq.in. in the concrete. These figures are said to represent a safety factor of about 5 on ultimate strength.

Water Supply "Gift" May Prove Expensive for Austin

BY JULIAN A. MONTGOMERY
Chief Office Engineer, State Highway Department, Austin, Tex.

UNUSUAL conditions were attached to the acquiring, on Oct. 2, of the Barton Springs as an auxiliary to the present water-supply of Austin, Tex. It was a case of school board arrayed against city administration, and the school board won out, largely because of political reasons.

During the past year there has been considerable agitation regarding the water situation in Austin, a discussion of which was given by the writer in *Engineering News-Record* of Aug. 23, 1917, p. 355. The quality of the water has been improved greatly by the use of chlorine and the acquisition of the sand beach on which the water plant is located. However, the quantity has been so curtailed as a result of the dry weather prevalent for the past year and a half that the city took steps toward increasing the supply. As was proper, before adopting plans covering methods, location, etc., the city began preliminary investigations of the various possible sources of water-supply, including Barton Springs.

The Barton springs are located about 1½ miles southwest of Austin and consist of a group of fissure springs whose source is supposed to be in the highlands to the west of Austin, where the rain seeps down through the many joint and fault planes to the water-bearing layers of rocks below. Their daily flow ranges from 10,000,000 to 40,000,000 gal., depending upon the rainfall. These springs are owned by a defeated candidate for the office of mayor of Austin, who gave them to the school board provided the city would purchase them for $100,000 from the school board, the fund to be set aside as a memorial fund to this defeated candidate, and the interest to be used for manual training purposes. Naturally, the school board urged the purchase, even though a fund was provided already for manual training, and even though the 55 acres on which the springs were located were assessed for taxation at about $800.

Coming at the time it did and with the conditions imposed, the offer was embarrassing to the city administration, which was going carefully, but probably too slowly, into the question. Because the preliminary investigations were not finished at the time of the election, and because the people were impatient to obtain more water at once, and because of the political turn given to the question, the economic aspects were so clouded that there was forced on the city a source of water-supply which probably will prove more expensive and less desirable than some of the other sources that were being investigated.

Besides the $100,000 for the springs, it will cost something like $150,000 to bring the water to the city.

Trinitro-Toluol to Replace Dynamite?

MANY byproduct coke plants in this country are already engaged in recovering quantities of trinitrotoluol for manufacturing munitions, and many more plants which will recover this explosive are going up. Its superiority to picric acid was plainly demonstrated early in the war. It is now a question, according to Milton A. Allen, writing in the *Mining and Scientific Press* of Nov. 10, whether the trinitro-toluol which is recovered by these plants cannot be put on the market in competition with dynamite as a commercial explosive after the war. On the face of the matter, trinitro-toluol is a much more desirable commercial explosive than nitro-glycerine. It does not freeze, does not melt until a temperature of 81° C. is reached, does not ignite until a temperature of 300° C. is reached, and even then does not explode, does not give off the slightly volatile gases which produce severe headache when dynamite is handled, and does not deteriorate under water. The only serious objection to its use is that the explosion produces a large volume of carbon monoxide gas. However, this is also the case with nitroglycerine, and dynamites used for tunnel driving are mixed with nitrate as an oxidizer to prevent the formation of this gas. The same thing could, of course, be done with trinitro-toluol. Apparently, the chief thing remaining to be worked out is the process of putting the explosive up in convenient form for handling, as is done with nitro-glycerine in dynamite sticks.

New York Pavement Openings

In 1916, according to the annual report for that year of Marcus M. Marks, president of the Borough of Manhattan, New York City, there were made about 30,000 openings in pavements, requiring the restoration of about 155,000 sq.yd. of pavement. The openings, according to the report, were made principally by public utility corporations.

Concentrated Pressure Causes Many Pavement Failures

Brick Surfaces Particularly Suffer Because Grout Is Frequently Unequally Distributed Over Area of Vertical Face

By A. H. Hinkle
Deputy State Highway Commissioner, Columbus, Ohio

THE initial cause of many defects and failures in rigid pavements, such as brick with cement filler and cement concrete pavements, can be explained by considering them as the result of an abnormal concentration of pressure. As an example: Take a single English walnut in one hand and you may not be able to grip hard enough to crush it. In fact, you may not be able to crush it by using both hands. But take two English walnuts in the hand and you will be readily able to crush one of them. Nor is this hard to explain. In the first instance the flesh of the hand distributed the pressure over a considerable area of the shell of the nut, but in the second instance the entire pressure was concentrated on a very small area of the nutshells which were in contact one with the other. This concentration of pressures, and not the intensity of the gripping force, was the cause of the failure.

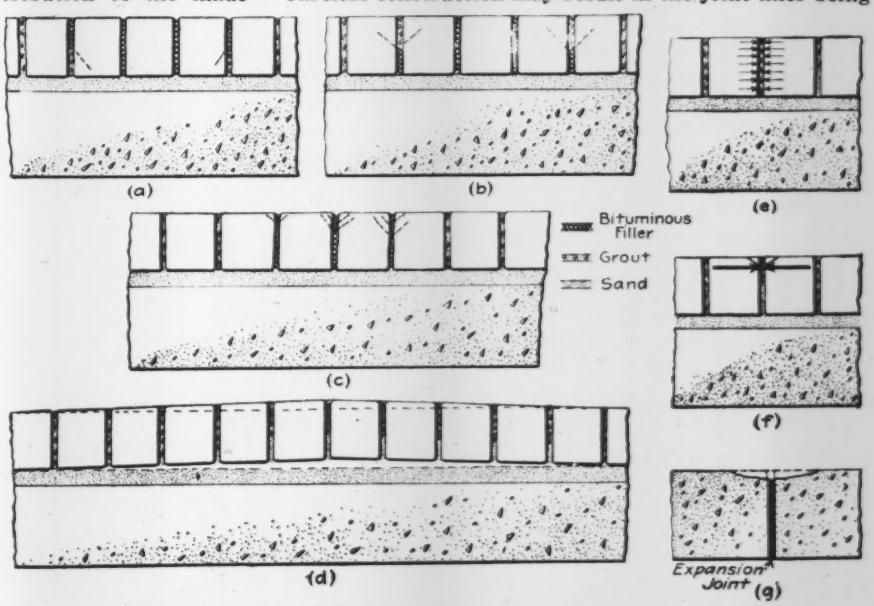
Frequently a failure of a cement grouted brick pavement can be explained in this manner if the joints have only been filled for a short distance from the top. Were the pressure causing the failure distributed over the whole face of the brick, it would be able to withstand the destructive forces, but the concentration of the same total pressure on a small portion of the depth is sufficient to crush that part of the brick.

Partial filling, therefore, usually results in spalling off and crushing the wearing surface of the brick and grout filler. This may occur in small patches or over larger areas, depending upon the distribution of the inadequate filling. An examination of the small patches that have failed in an otherwise satisfactory g r o u t-f i l l e d brick pavement will usually reveal the fact that a large percentage of the failures are concomitant with an insufficient filling of the joints. In sandy countries it will be found that sand will drift into the joints after the brick are laid and before the grout filler is applied. If the brick are disturbed after they have been placed on the sand cushion there will result an upward movement of the cushion sand, and furthermore leaves blown into the joint in the fall of the year will be found to be another source of trouble when an attempt is made to completely fill the joints with cement grout.

The almost universal recurrence of crushed brick along the transverse expansion joint in a brick pavement is largely traceable to the concentration of the pressures over a small area of the brick. It must be admitted that this is not the entire cause of such failures, but it holds true generally in that type of joint which is made by filling nearly full with asphalt the three or four transverse joints and then sweeping over these joints with the grout. The result of this method of construction is well illustrated in one of the accompanying views which illustrates the conditions that obtain not only when the joints are filled with asphalt first, but but when they are purposely left empty while the rest of the pavement is being grouted and then filled later with the expansion material. Concentration of pressures under condition of expansion is invariably the result of this method of construction. In some cases the irregularity of the brick causes actual contact between them, or a hard pebble may drop into the joint and become wedged, producing the same effect on a small enough area to exceed the compressive strength of the brick. Hence the brick at such a point spall off or crush badly. This type of joint, happily, is going out of use.

But beyond this pure surface spalling due to only a partial filling of the joints, "blow ups" are frequently traceable to the same class of faulty workmanship. It may be readily seen that the concentration of the pressures on the upper half of the brick surface produces, in effect, a toggle joint which, when the pressures have reached a sufficient magnitude, will inevitably result in an upheaval of the surface. While it is recognized that incompletely filled joints are not the prime and only cause of such failures, it has been observed that "blow-ups" frequently occur at places where the grout has not penetrated for the full depth of the brick.

The same theory of concentration of pressures can frequently explain spalled joints in concrete pavements. Careless construction may result in the joint filler being



CONCENTRATION OF PRESSURES MANIFESTS ITSELF IN MANY WAYS

(a) Poured transverse joints with grout at bottom. (b) Same; grout applied after pouring pitch. (c) Pebble wedged between brick. (d) Lower portion of joints filled with sand from cushion causes "heaving" under some conditions. (e) A full joint distributes pressures resulting from expansion, while (f) spalling is precipitated by uneven filling. (g) Concrete pavement joint set below finished surface

set from ¼ in. to ½ in. or even more below the intended surface of the pavement. In this case, of course, the concrete when laid extends over the expansion material and the stresses set up by an expansion of the pavement concentrate in this thin layer. The condition following such faulty construction is illustrated in one of the accompanying illustrations and the amount that will spall off will depend a great deal upon the depth of concrete over the joints.

Engineers very frequently forget that a pavement is not a fixed structure but is continually changing its volume. While the expansive forces due to the increase in volume may not be very great, in any pavement which is of the rigid type it is necessary to take them into account. Of the two recognized methods of doing this, one is to design the pavement slabs strong enough to withstand the temperature stresses, and the other provides amply for the expansion by means of joints spaced appropriately and constructed of such materials as to allow of compression when the pavement has a tendency to increase in volume.

That the variable density of the sand cushion in certain kinds of foundations at the tme of construction may later cause "hollows" under the brick is recognized and known as a source of trouble. This was commented on in *Engineering Record* of July 3, 1915, page 3, and Aug. 7, 1915, page 175. The importance of a good foundation or support under a brick pavement should not be discredited. This article is not intended to lessen the importance of the foundation, but rather to explain an additional cause for a certain class of defects in construction which may be the sole cause of trouble that is too frequently attributed to the use of poor materials.

In addition, if defective grouting occurs over a place in the foundation which offers little support to the brick, failure will inevitably occur at this point, and while either the defective foundation or defective grouting would have been sufficient in itself to cause failure under heavy traffic, the two defects occurring at the same place are certain to cause failure.

If engineers are acquainted with the theory upon which such failures as mentioned above are based, they will be more on guard against the defects in the original construction of the surface which may lead to such failure, and it is with hope that attention may be focused upon this question that the above matter is presented for consideration.

Handling Freight on New York's New Steamship Pier

Equipment Details for Forty-Sixth Street Wharf on Hudson River Represent Latest Ideas of Steamship Men

By C. W. Staniford
Chief Engineer, Department of Docks and Ferries, New York City

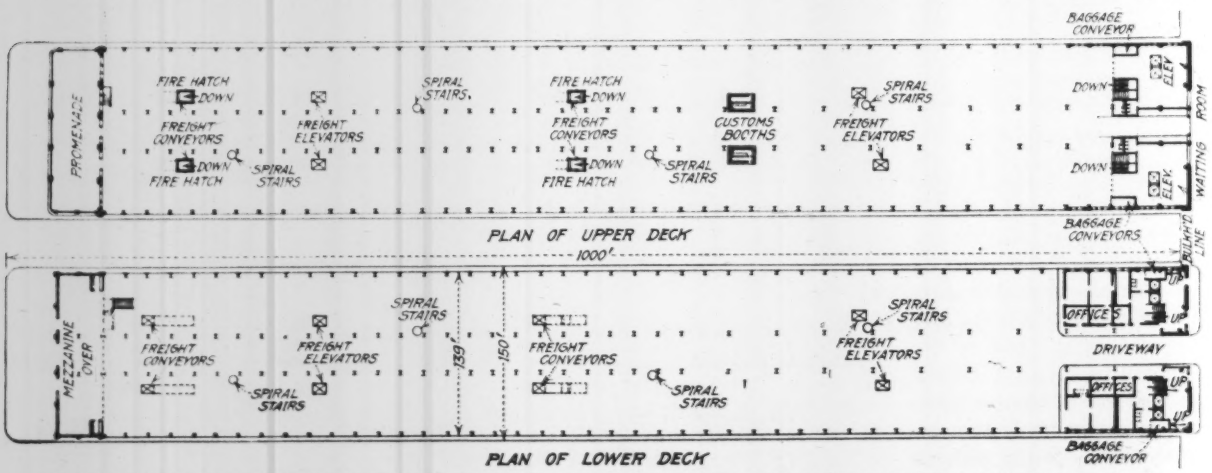
THE new 1000-ft. pier at the Hudson River foot of West 46th St. in New York City is now being equipped with freight handling machinery to fit it for steamships of extreme length and draft. While the leasing company and consequently the boats that are to use the pier have not yet been decided, it is thought that the methods of handling freight on this new pier will represent the latest ideas of steamship men, mainly because the layout is the result of a series of conferences between the Department of Docks and Ferries and representatives of all the leading steamship lines entering New York.

The result of these conferences may be abstracted as follows:

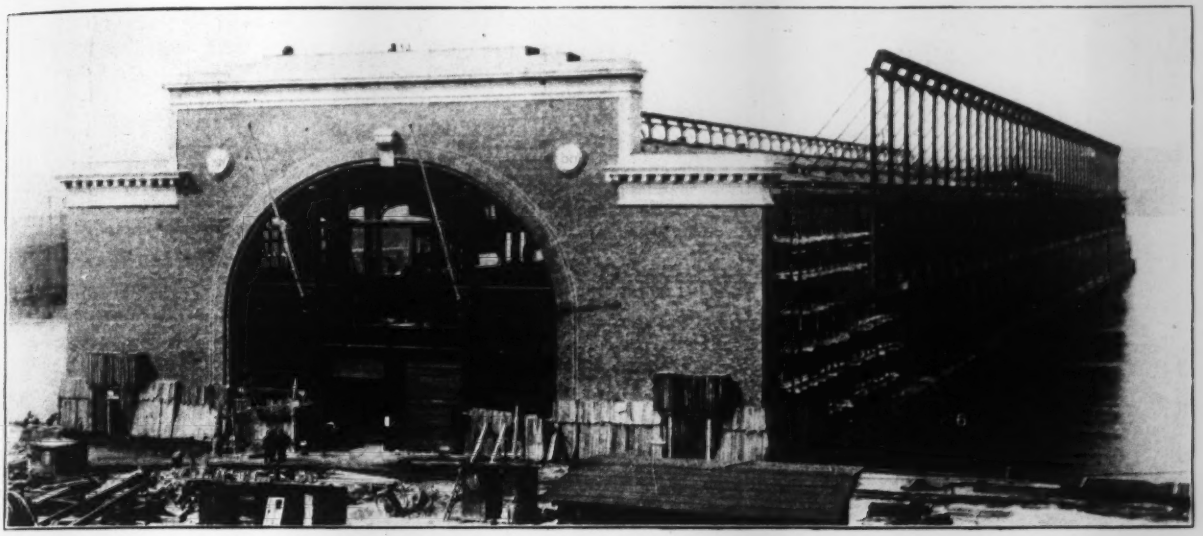
1. All the representatives agreed that the method of handling freight by the use of the extended columns forming cargo masts similar to those already in use at Hoboken, on the Chelsea piers and many other piers in New York Harbor, was the only method to be considered, and consequently this system has been provided, as explained by the writer in an article in *Engineering News-Record*, May 31, p. 453.

2. In all other two-story sheds, freight is handled from the upper to the lower deck by the means of freight elevators. One of the steamship companies concluded that it would prefer to use freight conveyors or escalators in place of the ordinary freight elevator. Other companies preferred to maintain the present practice of using freight elevators.

3. A common practice in New York in unloading cargo



PLAN OF TWO FLOORS OF WEST 46TH ST. PIER, NEW YORK CITY, SHOWING FREIGHT-HANDLING LAYOUT



WEST 46TH ST. PIER IN NEW YORK CITY APPROACHES COMPLETION

from the second to the lower deck is by means of an inclined plane surface in the form of a chute from upper to lower deck. With fragile freight these chutes are objectionable on account of the shock received by the package, but are generally deemed desirable for ordinary freight.

4. An unusual idea advanced was the feasibility of placing a movable platform or belt arranged level with the deck inside of the shed and near its side. This moving sidewalk would be used to carry packages immediately upon delivery from the slings to any part of the pier where it might be desirable to deposit them. On account of the cost of this installation, the questionable desirability and uncertain use to which it might be put, and also on account of its interference with other necessary freight handling functions on the pier, the company presenting this plan finally abandoned it.

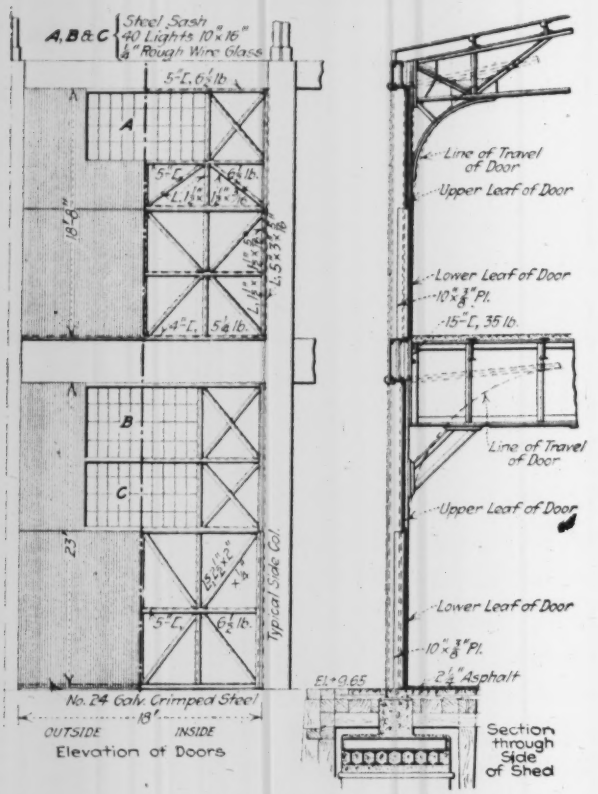
The shed on the West 46th St. pier is now nearing completion and the contract for the mechanical equipment is in force, although the future occupant of the pier is not known. In preparing this contract, therefore, it was impossible to know the exact desires of the future users or lessees of the pier, and on this account a combination of the above requirements has been arranged for in the contract so that any of the larger steamship companies may have the equipment which it desires.

The pier is the one made familiar in the technical press by the long steel cylinder cofferdam laying dry the shore section so as to permit the construction of the side walls in the open. It is 1000 ft. long and 150 ft. wide and carries a two-story shed 139 ft. wide and 921 ft., long with an out-shore one-story extension 47 ft. long. The head house, a brick enclosure of the typical steel-frame section, contains offices on both floors and the remainders of both floors are open to the far end, the lower floors being used mainly for freight handling and the upper for baggage and passengers. At some future time, however, the proposed west side marginal railroad may pass in front of the pier, in which case railway entrance will be afforded directly to the second floor where provision for that purpose has been made. At present there is no vehicle access to the second floor except by elevator and no railway connection at all.

The general disposition of the handling equipment is shown in one of the drawings. There are two passenger elevators on each side at the street entrances, four freight elevators between the upper and lower decks and four freight conveyors or escalators between the upper and lower decks. On account of the uncertain use and desire for the freight chutes they have been omitted, inasmuch as they can be easily placed, without much trouble and expense, at the exact point where they may be desired by the future lessee. Near the street entrance to each pier, two baggage conveyors or escalators are placed at convenient points.

The pier has been wired and equipped with 56 receptacles for the operation of portable electric hoisting winches. These receptacles are so disposed on each deck of the pier as to handle adequately the cargoes of all steamships using the pier. The pier is thoroughly wired and lighted in both decks and offices, current to be supplied from outside. The steam heating is complete, steam pipes being carried and wrapped to all water mains throughout the pier and also to offices, from its own steam boiler room plant. Water-supply for watering ships and for fire protection is provided.

Cargo masts of the latest type have been provided on the sides of the shed. The columns are spaced 20 ft. apart and are extended above the roof level to a height of 80 ft. above the first floor level. The columns are connected at their tops by steel girders, providing a sufficiently rigid support for the blocks handling cargo to the upper and lower decks. The extreme height of 80 ft. was determined upon on account of the steamships of extreme size which will use this pier. The steel girders are extended out from the side of the shed a distance of about 2 ft., by means of a curved built member. This serves as a further protection of cargo against the sides of the shed and gives an easier approach for cargo. The door-heads are protected by means of fenders of curved steel plates filled with cement grout.



STEEL-CLAD DOUBLE DOORS ON PIER SHED FOLD BACK UNDER ROOF

It is expected that the occupant of the pier shed will use electric hoisting winches, but the present equipment contract does not call for them. The department has recently installed six on the 35th St. pier, Brooklyn, to be used similarly to those to be installed at the West 46th St. pier. These winches are portable and are mounted on a steel bed-plate on four wheels, one pair of which is provided with bell cranks so that the winch may be properly steered when moving from one location to another. The center winding drum, 30 in. in diameter, 28-in. face, is mounted on a 4⅞-in. diameter shaft. Winch heads, 21 in. in diameter and 15-in. face, are mounted on each end of the shaft. The motor is a 35 hp., 500 r.p.m., 230 volts d.c. A solenoid brake is provided. A master controller, provided with shoulder hooks, weighing about 10 lb. and arranged to be carried about and operated by one man, is connected by cable to the controller. The combination of controller and master provides six lowering speeds and four hoisting speeds. The winches can hoist 2150 lb. at a speed of 350 ft. per minute.

The freight elevators are capable of carrying a maximum live-load of 6000 lb. at a speed of 70 ft. per min. The floor of the car is 8 x 12 ft. The passenger elevators are 6 ft. 6 in. x 8 ft., and are capable of carrying a maximum live-load of 3800 lb. at a speed of 150 ft. per min. The machines for operating the elevators are located at the top of the elevator shafts and are of the single worm-and-gear type keyed directly to the winding drum, operated by 20 brake h.p. motor, 2 hr. rating, with 240 volts d.c., at 800 r.p.m. Elevator pits are cut into the pier deck and are depressed 4 ft. The framing is of heavy timber, with the floor and walls tightly calked and lined with No. 10 galvanized sheet iron.

Baggage conveyors have a run of 56 ft. with an apron 3 ft. 10 in. They are supported on light plate-girder frames, designed to carry two tons distributed load at a speed of 75 ft. per min. in either direction. The upper end is 6 in. above the level of the deck so that baggage will be dumped from the high point to the floor. The traveling apron is made of oil finished strips of maple, 1½ in. thick and 6 in. wide, bolted to two carrier chains. Cleats on 8 in. centers are fastened to the maple strips with forks meshed in between at the ends of the conveyor to steal the loads from the conveyor. The conveyors are driven by 10 hp. continuous rating compound-wound motor, with direct current at 240 volts, 840 r.p.m. Push button control switches are furnished at each end.

Freight conveyors, similarly constructed with a run of 53 ft. and a width of 4 ft., 4 in., are designed to carry a distributed load of 6 tons, and operated by a motor of 30 hp. capacity. The conveyor wells on the second deck are protected by pipe rails with gates, and covered by a counterweighted lift door. The lower ends are set in pits similar to the elevator pits.

In handling freight the door equipment is of great importance, as it is necessary to have a door which can be easily operated, which will interfere the least with handling and storage of cargo and will be as weather-proof as possible. These conditions preclude the use of ordinary sliding doors, and in the West 46th St. pier it was determined that some form of lift type should be adopted. The door finally decided upon, shown in one of the drawings, is made by the J. Edward Ogden Co., of New York City. The doors fill all of the openings between columns on both sides of the pier.

Contrary to the usual practice in pier doors, which are generally of wood or wood covered with sheet metal, these are of light structural steel framework covered with sheet metal, which makes them light and easy to operate, and very materially reduces the fire hazard. At the same time they are about as economical as the wooden doors. The doors fit snugly to the jambs and lintels and against a cast-iron weather stop at the deck of the pier, thereby making the openings virtually stormproof. They are in every way the most admirable type of door for pier shed requirements.

The whole design and construction of this pier and shed, including the mechanical equipment, has been carried out under R. A. C. Smith, commissioner of docks, by the writer, assisted by R. T. Betts, deputy chief engineer, and T. F. Keller, assistant engineer.

Seattle Water-Supply Improvement

In *Engineering News-Record* of Nov. 8, p. 901, it was stated that "the plans and specifications for the proposed extensions to the Cedar River Water system of Seattle will be completed under the direction of L. B. Youngs, superintendent of the water department, and sent to the Board of Public Works for approval." These plans and specifications are being prepared and the actual construction will be carried on by the city engineer's department, with T. H. Carver in direct charge as water-supply engineer.

A New Method of Constructing Difficult Foundations

Column Footing Was First Built on Group of Short Concrete Piles, and These Were Later Jacked Down to Desired Load Capacity

By Edmund Astley Prentis, Jr.
Underpinning Engineer for Smith, Hauser & MacIsaac, Inc., Contractors, New York City

During the construction of the subways of New York City, particularly in the skyscraper district of Manhattan, a great deal of underpinning has been done. Some of the problems that confronted the contractors, especially on William St., had never been met before but have now been successfully solved, as the subways have nearly all been completed with virtually no damage to buildings. In doing this, many improvements have been introduced from time to time, as the engineers and contractors found occasion for them.

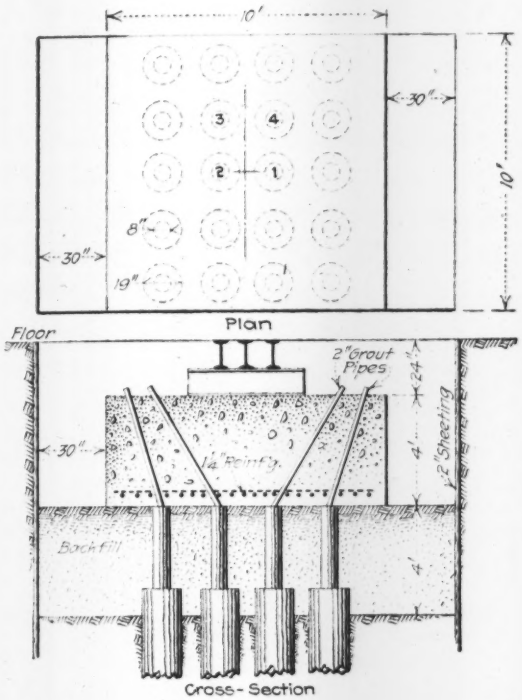


FIG. 1. COLUMN FOOTING IN FIRST STAGE; ULTIMATE CAPACITY TO BE 1000 TONS

From experience in carrying on this work, a new method of constructing foundations for new buildings has been developed. The method may be said to consist of underpinning the building during its erection, so that the construction of the foundation goes hand in hand with that of the building itself. It is evident that with such a method a great saving in time can be obtained, where for instance caissons would be needed to carry the column loads. In other words, where there are heavy loads to be carried, with rock at such depth that short piles would not reach it, and a spread foundation is out of the question, this new method would supplant caissons.

When a caisson foundation is used, neighboring buildings are always disturbed by the action of the compressed air and by the loss of ground. Furthermore, the time needed is from six months to a year, depending on the depth to be reached and the magnitude of the work. Again, after the lapse of this time the caisson, capable of carrying say 1000 tons, is at first loaded with a steel column weighing only five or six tons, and the full load is not applied to the column support until after the lapse of eight months or a year more, or until the building is completed.

The foundations used in the method about to be described are designed in the usual way as pile foundations. A pile 19 in. in diameter, with a steel shell $\frac{5}{16}$ in. thick, filled with concrete, is allowed 50 tons by the New York building department, which allows 350 lb. per sq.in. on the concrete of the pile. The shells for the piles, in short sections, are driven a small distance into the ground, from 5 to 10 ft., by means of a hammer, and are cleaned out and concreted. Wooden blocks 3 or 4 ft. long are placed on top of the piles and the space around the blocks and the tops of the piles is backfilled with carefully tamped earth. A reinforced-concrete girder with the necessary grout pipes is then cast on this backfill and posts, thus supplying a prelminary support for the column loads. The footing so constructed is ready for the beginning of the construction of the building. (See sketch, Fig. 1.)

When the building has reached a height of three or four stories—of perhaps twenty to be built—the second stage of the construction proceeds. The column will

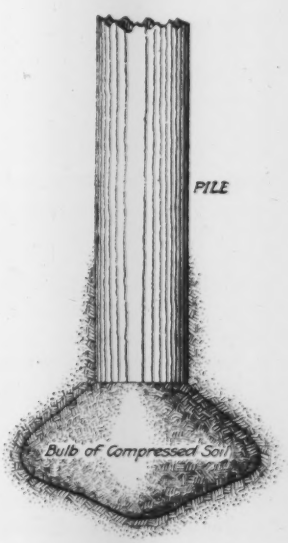


FIG. 2

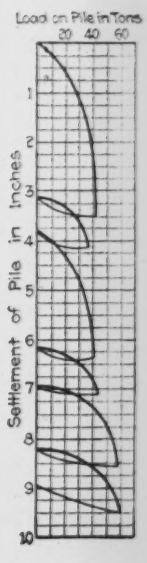


FIG. 3

FIG. 2. SKETCH OF THE BULB OF COMPRESSED SOIL UNDER PILE FOOT. FIG. 3. PILE-SETTLEMENT CURVES SHOW REBOUND AND SETTLEMENT AFTER EACH LOADING

have perhaps 100 tons weight on it at this time, or if not a slight upward thrust would cause it to borrow load from adjacent columns. The weight of the column plus that of the girder (which weighs about 25 to 30 tons) is sufficient for jacking purposes.

Through the open trench on either side of the girder access can be had to the backfill, which is dug out sufficiently to allow access to pile No. 1. The block of wood which rests on it is removed, and a cast-iron cap 2 in. thick, 21 in. long and 15 in. wide is placed on top of the pile. A hydraulic jack 12 in. high with a ram 6 in. in diameter is placed on the plate and the jack reacting against the reinforced-concrete girder forces the pile into the ground, until a reaction of 75 tons is obtained, which is 50% more than the assigned load. If the pile settles so that its top is at the bottom of the pit, a new section of pile is added on and filled with concrete, whereupon the jacking or testing is done over again.

When the desired 75-ton reaction is obtained, the pile is wedged up by means of two 6-in. I-beams or their equivalent, one on each side of the jack, without releasing the load on the pile. When wedged up the jack is removed and the wedging I-beams are concreted in as well as the constricted space allows. Final contact is made by means of the grout pipes provided in advance through the girder.

The same operation is gone through for piles No. 2, No. 3, No. 4, etc., until all the piles have been tested, wedged and concreted in, and the foundation is finished by the time the building is completed. The same work is done of course for all the footings.

The method of wedging the piles is of fundamental importance, as this is the active means of supporting the building permanently. It is known from many tests that in many soils a cylindrical pile settling under load forms at its base a bulb of compressed soil, the shape of which has been proved to be as shown in the sketch, Fig. 2.

When the load is released, the pile rebounds slightly and the integrity of this bulb of pressure is impaired. Reapplying the load causes the pile to settle to a new and deeper level until this bulb of compressed soil is reformed. A pile settlement curve, of many hundreds observed, is shown in Fig. 3. The method of wedging described above, with the cap and ram, prevents the pile from rebounding when the ram is removed, maintains the bulb of compressed soil at the base of the pile, and actively puts the load on the two I-beams which were wedged in position on either side of the ram.

Two foundation contracts using this method (for which patents have been granted) are at present nearly completed on William St., New York, one for a 12-story and the other for a 20-story building. Smith, Hauser & MacIsaac, Inc., are the contractors and Lazarus White is their directing engineer.

Detroit Belt Driveway Completed

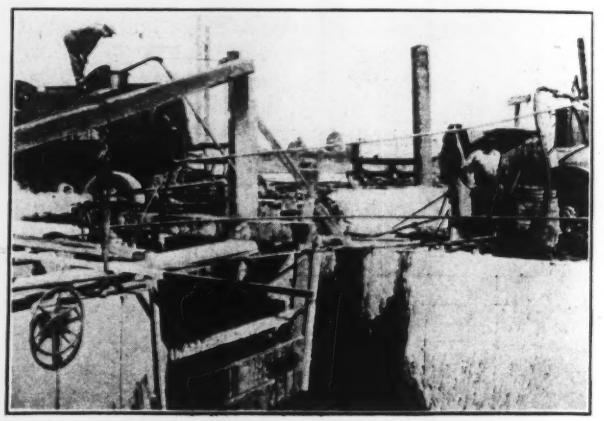
Opening of the outer-belt drive of the Wayne County concrete highway system was celebrated at Detroit, Oct. 11. This marked the completion of a continuous line of about 94 miles of hard road, skirting the boundaries of the county and intersecting the ten radial highways which center at Detroit.

Temporary Oil-Heating Plant Saves 40-Mile Truck Trip

By E. Earl Glass
Los Angeles County Road Department, Monrovia, Calif.

PENDING the installation of the heating and pumping machinery for its new 8-car capacity oil station for Division No. 1, the Los Angeles County (Calif.) Road Department is supplying road oil from this point by means of a makeshift outfit gathered principally from the scrap pile. The cost of erecting this plant was negligible except for the labor, and it has saved the oil-distributing trucks a 40-mile trip for their loads. The cost of operation is extremely low, being $3 for a fireman and $2 for fuel for an 8-hour day.

The scheme of operation is particularly simple. The railroad tank cars of 70% asphaltic oil are unloaded



PUMP IS SUSPENDED FROM BEAM IN HEATING CELL

by gravity to the middle compartment of the concrete pit shown in the illustration. A corner of this pit, measuring 6 x 8 ft., was partitioned off by planks and utilized as a heating cell. A steam coil, consisting of a grid of 1¼-in. pipe on 5-in. centers terminating in a large flat spiral, was laid on the bottom of this cell. The 5 x 8-in. steam pump was hung in the pit from a beam, and maintained just above the oil surface by a tackle and windlass. The suction projects down into the spiral coil mentioned above. The warm oil is pumped through a retort which is a coil of eight lengths of 2-in. pipe in a 24-in. steel casing laid on the ground, fitted with a stack, and heated by an oil burner. From here the hot oil goes to the loading riser. The valve on the end of the steam coil is left slightly open to maintain a circulation of live steam in the coils.

Steam for the coils, pump, retort burner and car-heating coils is furnished by a 24-hp. portable boiler. This outfit, simple as it is, can heat and load an 1100-gal. truck tank of 70% oil to 350° F. in 70 minutes, or if the temperature is raised to only 220° F., the operation can be completed in 50 minutes. A little trouble is experienced in handling natural asphaltic oils, as the water content causes considerable foaming over the coils and often in the truck tanks. This is particularly true, of course, at the lower temperature—the water being virtually all driven off at 350 degrees.

Manganese in the Water Supply of Pierre, South Dakota

Two-Inch Mains Badly Clogged — Aeration and Milk of Lime Treatments Prove Effective in Laboratory Tests

By J. W. Sale

First Assistant Chemist, Water Laboratory, Bureau of Chemistry, U. S. Department of Agriculture, Washington, D. C.

IN OCTOBER, 1916, the Board of Commissioners of Pierre, S. D., forwarded to the Bureau of Chemistry, U. S. Department of Agriculture, for examination a finely divided, black deposit which had been taken from a clogged water main of that city. A preliminary examination showed the material to consist chiefly of oxids of manganese. The deposition of manganese compounds in water mains has been reported so infrequently, especially in the United States (J. Am. Chem. Soc., Vol. 26, p. 714, 1904; Proc. Ill. W. S. Assoc., p. 210, 1912, ibid, p. 81, 1913) that the results of the examination of such a deposit, the composition of the water supply, and the consideration of methods for removing the manganese from the water, are of general scientific interest.

The results of a complete examination of the black deposit from Pierre, S. D., are set forth in Table I.

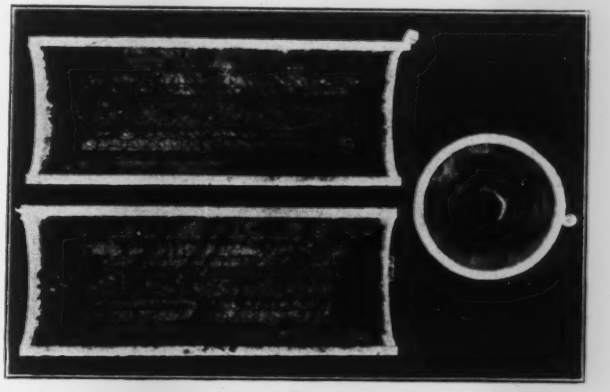
TABLE I. COMPOSITION OF DEPOSIT IN WATER MAINS AT PIERRE, S. D. (DRIED AT 110° C.)

	Per Cent.
Silica (SiO_2)	8.38
Manganese dioxid (MnO_2)	58.68
Manganous oxid (MnO)	11.43
Ferric oxid (Fe_2O_3)	1.25
Alumina (Al_2O_3)	1.95
Calcium oxid (CaO)	3.64
Magnesium oxid (MgO)	0.40
Barium oxid (BaO)	0.72
Carbon dioxid (CO_2)	2.26
Sulphur trioxid (SO_3)	2.24
Chlorin (Cl)	0.02
Water (H_2O)	9.25
	100.22

Available oxygen 10.8%; phosphorus pentoxid (P_2O_5) 0.00; sodium and potassium, trace; plant tissue, absent; sulphur trioxid (SO_3) calculated.

The chief source of supply is a large open well, about 50 ft. in diameter and 50 ft. deep, situated about 150 yd. from the channel of the Missouri River. In the ordinary water stage the well contains from 12 to 15 ft. of water. The water is pumped 1.8 miles to a reservoir which holds 500,000 gal. This reservoir is thoroughly cleaned twice a year, about ¼ in. of black deposit being removed at each cleaning. During the summer months the consumption of water is about 1,000,000 gal. a day, the daily average for the year being about 700,000 gal. No clogging of the mains has occurred at any points far removed from the line which leads from the well to the reservoir, virtually all of the trouble being found in service pipes which lead directly off of this main, and the closer to the well, the more trouble. These pipes close up in from one to four or five years where the trouble is most acute, so that it becomes necessary to re-lay the mains at frequent intervals in order to obtain an adequate supply of water. It has been the custom to scatter a barrel of lime in the well about once in every two months to destroy a vegetable growth which springs up in the summer months.

In November, 1916, a specimen of clogged pipe, 2 in. in diameter, was obtained. The pipe, which was taken from the cooling system of one of the engines at the pumping plant, was almost closed with the manganese deposit, as shown in the photograph, the opening for the passage of water being only ¼ in. in diameter. The pipe had been in use only six years. It was not injured by corrosion and, if cleaned out, would have given many more years of service. There were no tuberculations.



CROSS-SECTION AND TRANSVERSE SECTION OF TWO-INCH WATER-SUPPLY PIPE CLOGGED WITH OXIDS OF MANGANESE

Representative samples of the city water-supply were collected in November, 1916, and April, 1917. The analyses are contained in Table II.

These analyses showed that the total amounts of dissolved mineral constituents in the samples from different parts of the system varied considerably. This is, perhaps, not surprising in view of the location of the well close to the channel of the Missouri River. The content of manganese in the well water remains fairly constant. The unusual character of the water with regard to content of manganese and iron is shown also, the source of

TABLE II. VARIATION IN COMPOSITION OF WATER SUPPLY AT PIERRE, SOUTH DAKOTA

(Results given as milligrams per liter)

	Well*			Reservoir (1.8 Miles from Well)	Indian School (3.1 Miles from Well)	State House (¾ Mile from Well)	
Date collected	11-16-16	4-6-17	4-26-17	11-16-16	11-16-16	4-6-17	4-26-17
Silica (SiO_2)	23.0			24.4	22.6		
Sulphate (SO_4)	163.7			208.1	191.4		
Bicarbonate (HCO_3)	210.5	241.0	265.4	234.8	227.2	256.2	256.2
Nitrate (NO_3)	0.0			0.0	0.0		
Nitrite (NO_2)	0.2			0.0	0.0		
Chlorin (Cl)	25.0	40.0	77.0	86.0	79.0	100.0	100.00
Iron (Fe)	**	**	0.07	**	**	**	0.09
Manganese (Mn)	2.3	2.42	3.00	0.3	0.5	0.77	0.08
Calcium (Ca)	60.2			74.1	69.4		
Strontium (Sr)	2.7			2.8	3.0		
Magnesium (Mg)	19.1			27.2	25.6		
Potassium (K)	6.1			7.2	6.6		
Sodium (Na)	61.9			101.5	94.6		
Oxygen required			2.4				2.0
Dissolved oxygen			5.2				7.0
Free carbon dioxid	16.0		6.0	25.3	29.7		11.5
Total dissolved mineral matter	574.7	692.5	824.7	766.4	719.9	860.1	889.1

* The precipitate which separated out on standing contained algae and diatoms. Crenothrix manganifera could not be identified.
** No weighable amount in one liter.

supply containing 2.3 mg. per liter of manganese and only a trace of iron. Usually water containing iron and manganese contains more iron than manganese.

The content of iron and manganese of a number of water supplies in the United States is given for purposes of comparison in Table III.

TABLE III. AMOUNTS OF IRON AND MANGANESE IN CERTAIN DOMESTIC WATER SUPPLIES

Water Supply	Milligrams per Liter Iron	Manganese
Cohasset, Mass	0 73	0 23
Brookline, Mass	0 60	0 26
Middleboro, Mass	1 49	0 75
Reading, Mass	1 21	0 004 to 0 56
Lowell, Mass	1 05 to 2 02	2 10 to 3 28
Newton, Mass	0 14	1 39
Babylon, N. Y		0 07
Bayshore, N. Y		0 37
Calverton, N. Y		0 30
Patchogue, N. Y		0 20
Superior, Wis	1 7	0 12
Mt. Vernon, Ill	0 6 to 0 8	0 58 to 0 64
Mt. Vernon, Ill	1 6	1 15
Lawrence, Kan	17 00	1 16
Pierre, S. D	0 07	2 3 to 3 0

It was noticed that the three samples of water collected Nov. 16, 1916, deposited a sediment on standing. Reëxamination of the supernatant water showed a marked reduction in the content of manganese after intervals of six weeks and 24 weeks (see Table IV).

TABLE IV. REDUCTION IN CONTENT OF MANGANESE IN WATER SUPPLY OF PIERRE, S. D., ON STANDING

Description of Sample	Milligrams per Liter Well	Reservoir	Indian School
Manganese content when received	2 3	0 3	0 5
Manganese content 6 weeks later	0 10	0 06	0 04
Manganese content 24 weeks later	0 03		

Since the water drawn at the city taps must necessarily pass through mains partially filled with the manganese deposit, a test was made to ascertain if the material was likely to be redissolved. It seemed probable that if there was any solution of the material it would be caused by a fresh supply of water with a high content of carbon dioxid. Therefore, a tablespoonful of the manganese deposit was placed in a champagne bottle which was then filled with Pierre well water (collected Nov. 6, 1916, and containing at the time of the experiment 0.03 mg. per liter of manganese and 0.02 mg. per liter of iron). The mixture was carbonated under pressure by means of a special apparatus devised by Dr. H. E. Patten, of the Bureau of Chemistry, and allowed to stand four days with frequent mixing. The pressure was then found to be 40 lb. per sq.in. The mixture was quickly filtered, using suction and the content of manganese and iron determined in an aliquot portion of the filtrate. The filtrate contained 0.62 mg. per liter of manganese and 0.05 mg. per liter of iron, showing the deposit to be practically insoluble even under the extreme conditions outlined above.

A portion of the filtrate obtained above was aërated for several hours by bubbling, allowed to stand 48 hours and quickly filtered, using suction. It was found to contain 0.11 mg. per liter of manganese.

A review of the methods for the removal of iron and manganese from water-supply has been issued recently by the University of Kansas (*Bulletin*, Vol. 17, No. 8, 1916, p. 24). The reader is referred to this publication for a description of the processes used in Germany and in the United States.

It is well known that manganese in water-supply cannot be removed always by the same treatment. The investigation included, therefore, some laboratory experiments on the removal of manganese from the Pierre water-supply. Knowing from the results given in Table IV that the content of manganese in the well water was greatly reduced on standing six weeks, some experiments were made on the sample of well water collected Apr. 26, 1917, with a view to the rapid removal of the manganese.

Several 500 c.c. portions of the sample were treated in different ways. One portion was aërated by bubbling; another portion was aërated by bubbling in the presence of a quantity of the manganese deposit; and other portions were treated with lime water. The details of these tests are given in Table V.

TABLE V. LABORATORY EXPERIMENTS ON REMOVING MANGANESE FROM PIERRE WATER-SUPPLY

	Milligrams per Liter of Manganese	Percentage Removable Manganese
Raw water (collected April 26, 1917)	3 00	
Raw water (containing 3.00 milligrams manganese per liter at time of test) aerated several hours by bubbling, allowed to stand over night and filtered	2 83	5 7
Raw water (containing 3.00 milligrams manganese per liter at time of test), aerated several hours by bubbling in presence of manganese deposit, allowed to stand over night and filtered	0 12	96 0
Raw water (containing 3.00 milligrams manganese per liter) after standing May 2 to 7, 1917	1 60	46 7
Raw water (containing 1.6 milligrams manganese per liter at time of test) treated with lime water at rate of 253 milligrams CaO per liter, mixed, allowed to stand ½ hour and filtered	0 02	98 8
Raw water (containing 3.00 milligrams manganese per liter), after standing May 2 to 10, 1917	1 10	63 3
Raw water (containing 1.1 milligrams per liter manganese at time of test), treated with lime water at rate of 63 milligrams CaO per liter, mixed, allowed to stand ½ hour and filtered	0 20	81 8

The results given in Table V indicate the raw water cannot be freed from manganese by plain aëration or by storing except for an inordinately long time. However, aëration in the presence of the oxids of manganese or treatment with lime water are very effective in precipitating the manganese.

Summary and Conclusions

The deposit which clogs up the water mains at Pierre, S. D., consists chiefly of oxids of manganese. The city water-supply contains manganese and iron in the unusual proportions of 2.3 to 3.0 mg. per liter of manganese and .07 mg. per liter of iron. The solvent effect on the manganese deposit of carbon dioxid mixed with the raw water under pressure amounted to only 0.62 and 0.05 mg. per liter of manganese and iron respectively.

Laboratory tests indicate the manganese in the water-supply can be largely removed by aërating in the presence of the manganese deposit and filtering or by treating with milk of lime and filtering. A high percentage removal of the manganese (68 to 97) is being obtained by deposition in the water mains near the well and in the reservoir. In view of this fact, the chief purpose of installing a small demanganization plant would seem to be to obviate the expense of re-laying or cleaning out at intervals the mains in the vicinity of the well. A consideration of the expenditure which would be involved in installing and maintaining such a plant is an engineering problem which does not lie within the scope of this paper.

Building Activity in San Francisco

Since May, 1906, the year of the great fire in San Francisco, to September, 1917, the Board of Public Works of the city has issued 71,745 building permits. The cost of the work carried on under these permits is estimated at $309,874,235. These figures given include only a portion of the work done on the Panama-Pacific International Exposition.

Reinforced-Concrete Building Has 2000-Pound Floor Load

Steel Storage Requires Thick Slab and Small Panels for Heaviest Load—Beam-and-Girder Type for Main Area

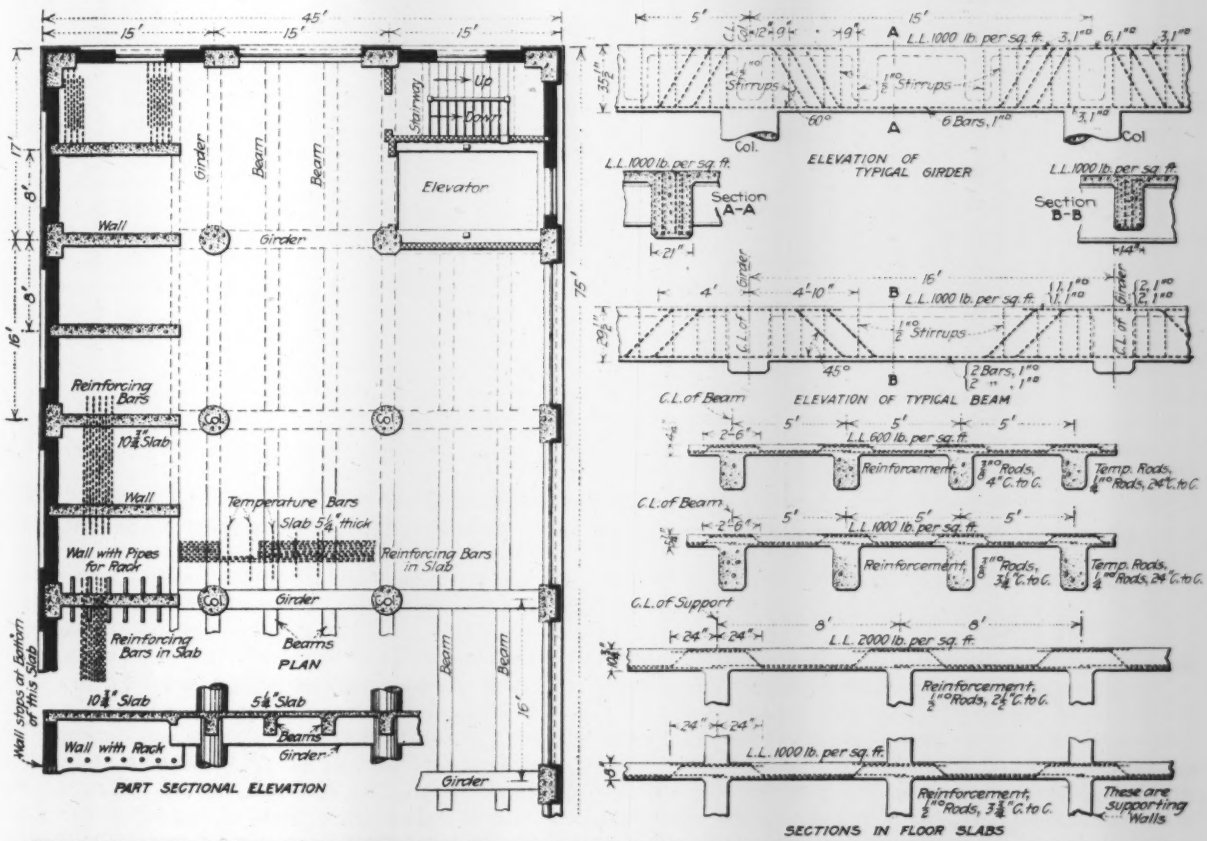
FLOOR loads of 1000 and 2000 lb. per sq.ft. as a maximum and 600 lb. as a minimum are an unusual condition provided for in the design of a warehouse and factory building now being erected in Chicago. These exceptionally heavy loads are due to the storage of steel plates and bars, while the lighter load is to provide for the reaction due to the operation of large punch presses. The building is approximately 45 x 75 ft., with five stories and basement.

The heaviest loading will be for a width of 12 ft. along one side of the second story, where steel bars will be stored. This portion of the floor, about 33% of the floor area, is designed for a load of 2000 lb. per sq.ft. Support is provided by 12 in. concrete partition walls which are built on the foundation girders and extend to the bottom of the heavily loaded portion of the second-story slab.

In the basement and first story these walls are utilized to support racks for the storage of steel rods. The racks are composed of rows of heavy pipes embedded in the walls and projecting 18 in. on either side. The remaining 67% of the second story and the entire area of the first story are designed for a load of 1000 lb. per sq.ft. The three upper floors are designed for 600 lb. per sq.ft. The foundation is a concrete slab laid directly upon the clay, and surmounted by girders running in both directions, as described in *Engineering News-Record* of Nov. 1, p. 826.

The interior columns are located at the intersections of these foundation girders. They are of circular section with the exception of one which is octagonal. Their outside diameter is from 27 to 32 in. in the basement, diminishing to 14 in. in the top story. The reinforcement consists of vertical bars, which number from six to 21 in the lower sections, according to the column loads. These bars are supplemented by spiral wire coils in the interior columns and by horizontal ties in the rectangular or wall columns. The bars are kept 1½ in. from the face of the concrete. The column spacing gives panels 15 x 16 ft. and 15 x 17 feet.

Special floor construction is required for those side portions which are to carry the heaviest loads. Here the slabs are made very heavy and the panels are subdivided into sections 8 x 15 ft. by the supporting 12-in. walls noted above. For the second-story portion carrying 2000-lb load the slab is 10¾ in. deep, and is reinforced with ½-in. round bars spaced 2½ in. on centers. For the corresponding portion of the first floor, where the load is 1000 lb. per sq.ft., the slab is 8 in. thick, with similar bars at 3¾ in. spacing. In the rear end panel, however, the bar spacing is reduced to 2½ in. and 3 in., respectively. All these rods run lengthwise of the building, or across the interior supporting walls.



PLAN OF REINFORCED-CONCRETE BUILDING HAVING FLOOR LOADS OF 1000 POUNDS AND 2000 POUNDS PER SQUARE FOOT. TYPICAL REINFORCEMENT OF GIRDERS, BEAMS AND SLABS FOR HEAVILY LOADED FLOORS

The floor design in the main area of these two stories and the entire area of the upper stories is of the beam-and-girder type. The girders extend between the columns, and each panel is subdivided by two beams extending in the direction of the greater length of the panel. The girders of the first and second floors are mainly 21 x 35½ ft., with beams 14 x 29½ ft. On the upper stories the girders are 16 x 31 in. and 14 x 28 in., with beams 12 x 23 inches.

The panel width being 15 ft. and the heavily loaded portion on one side only 12 ft. wide, the cross girders extend beyond the columns to cover this gap. The ends of these girders are built into the cross walls, and are connected by a small beam forming the edge of the thicker portion of the floor slab.

Over the beam-and-girder floor construction the slab thickness is 5½ in. on the first two stories and 4½ in. on the upper stories. The reinforcing bars in these slabs are laid transversely of the building, or across the beams and at right angles to the bars in the heavily loaded side slabs supported by cross walls. In the 5½-in. slabs there are ⅝-in. rods with 3¾ in. spacing. Across these, or lengthwise of the building, are ½-in. temperature bars spaced 24 in. center to center.

The beams and girders have straight bars, bent bars and stirrups. All the slab bars are bent to obtain cantilever action. The bending aids also in resisting the shearing stresses, thereby reducing the number of stirrups, so that in several cases these are entirely omitted. Deformed bars are used throughout.

Two grades of concrete are used for the columns, with a mix of 1:1:2 and 1:2:4. The richer mix provides for higher core stresses, in that section of the column inside of vertical bars, with proportionally reduced sectional area. The 1:2:4 mix is employed for the foundation slab, floors and roof.

Assumed Stresses

The stresses assumed for the 1:2:4 concrete are as follows: In compression, 400 lb. per sq.in. for direct load, and 700 lb. for bending. In shear, 120 lb. for direct shear and 40 lb. for diagonal tension. For reinforcing steel the stress is taken as 18,000 lb. per sq.in. for tension, 10,500 lb. for compression, and 12,000 lb. for shear. Its bond stress is taken as 100 lb. per square inch.

Heavy trucking will be done on the first and second floors, and here the surface of the slabs will be treated with "Vitrifyx." The upper floors will have 1⅜-in. maple flooring on sleepers embedded in a cinder fill over the slab. The roof will have a 3-in. slab, over which will be a cinder fill, sloped to drainage planes and covered with 1½ in. of cinder concrete. The exterior walls are of brick and have large window areas fitted with steel sash and wire glass.

The concrete for the foundation was placed by means of a spouting system which worked very satisfactorily, more than 27.5 cu.yd. being poured in each 8-hour day. This was accomplished in the face of unfavorable conditions due to congestion caused by the presence of old buildings, storage of contractor's material, and continual receiving and shipping of freight by the manufacturing plant.

A tunnel for trucking between this building and two of the old portions of the plant is a feature of the improvements. This is about 130 ft. long, extending under a yard, a building and a public alley. It is of rectangular section, 6 ft. 6 in. wide and 6 ft. 4 in. high in the clear. It has 12-in. walls and 5-in. floor and roof, except that under the alley the roof is increased to 8-in. to provide for the wheel loads of large motor trucks. This tunnel serves also for coal delivery to the power plant, as it connects three large vaults having an aggregate storage capacity of 1000 tons.

Fireproof private garages for the use of the officers of the company form another part of the improvement. These are of vitrified face brick and have roofs of concrete slab-and-joist construction with tile filling between the joists.

This building is being constructed for the Felt & Tarrant Mfg. Co. The architects are L. G. Hallberg & Co., and they also prepared the structural design. The Mueller Construction Co. has the contract for the work.

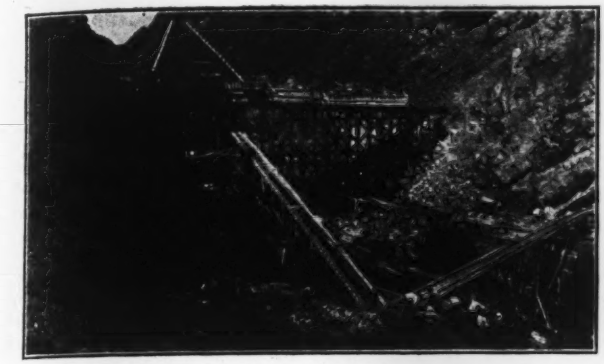
Arch Dam of Sharpest Radius Nears Completion

Motor Trucks Haul Materials 7 Miles to Dam Site on Cimarron River, New Mexico, at Mile-High Elevation

ONE of the shortest radius arch dams for its height yet built is nearing completion on the Cimarron River, New Mexico. The Eagles Nest dam is 140 ft. high, 30 ft. of which is below the river bed, and has a radius of 155 ft. It is 8 ft. wide at the top and 46 ft. at the base. It drains the Moreno Valley in Colfax County at a point where a red granite and porphyry dike, forming a prehistoric lake, has been cut through. The cañon therefore is narrow, 40 ft. at the base of the dam and 300 ft. at the crest. The project is to impound 80,000 acre-feet in the remade lake to irrigate 30,000 acres of the 400,000-acre Charles Springer cattle range.

As the dam is 6000 ft. above sea level, the season is short and construction must be carried on from April to October inclusive. However, work in cleaning and concreting the foundation progressed well into the winter last year, a house heated by steam pipes being built over the excavation. Only small dynamite charges were feasible because the river was carried through the house in a flume suspended from cables to give an unobstructed space below it.

Concrete is prepared in a central plant located at the downstream toe, below a crushing and screening outfit. The mixture of sand and gravel is hauled by motor truck from a point ⅝-mile downstream and dumped onto a grizzly shown in the foreground of the photograph. The finer materials are elevated to the screen and crusher outfit under the trestle. The conveyor crossing the stream brings material from the spillway excavation. The car on the track shown on the opposite bank carries rock plums, for embedding in the dam. At the trestle, these rocks are picked up by the traveling derrick. This derrick has a 65-ft. boom and is used also to lift the concrete buckets to the forms, from a track along the base of the dam.



TRAVELING DERRICK ON TRESTLE BELOW DAM HANDLES CONCRETE FROM MIXER TO FORMS

The spillway at the north end is in a granite saddle of the rock. It will have a length of 50 ft. and a depth below crest of 7 ft., giving, with 1 ft. freeboard, a capacity of 350 sec.-ft., which is in excess of the maximum flood recorded. The outlet tunnel through the rock at the south end has four inlets, at different elevations, leading into the gate-control shaft.

Two 5-ton White trucks, supplemented by teams, have done the local hauling and also that from the railway station at Ute Pass, 9 miles distant. Three or four trips a day are made over the road built for the purpose. This road is of disintegrated granite. A trip can be made in 2¾ hours. The high altitude cuts the gasoline mileage down to three or four per gallon. Only 20 to 30 trips would be possible with iron tires but the hard Goodyear rubber tires stand 2500 miles service, although gravel pit use cuts them out faster.

Work was pushed rapidly on the dam to complete as much of it as possible this year. Labor was scarce and hard to hold. The construction of the 6-mile unlined canal, which begins at the Cinvalco diversion works at the mouth of the cañon, 27 miles below the dam, is only 25% completed, because all available forces were diverted to the dam.

Bartlett & Ranney, San Antonio, Tex., are the consulting and supervising engineers, Willis Ranney being in direct charge. Neil Hansen is the superintendent of construction, which is handled by day-labor forces.

Foaming of Dallas Imhoff Tanks

By Charles Saville and R. H. Gould
Director of Sanitation, Health Department, Dallas, Tex. Of Staff of James H. Fuertes, Consulting Engineer, New York

THE Imhoff sewage clarification tanks at Dallas, Tex., were placed in operation early in January, 1917, and within a few weeks the gas formation in the sludge chambers of some of the tanks was so active, and the partly digested sludge so sticky, that foaming became very noticeable. Large amounts of the light gaseous sludge overflowed the walls of the sludge chambers into the settling chambers. The foaming was continuous in some of the tanks for days at a time.

It was noticeable that the foaming started first in the tanks at the upstream end of the inflow channel, which extends across the inlet ends of three tanks. There are four batteries of three tanks each in the Dallas plant all designed for horizontal flow at right angles to the direction of flow in the inflow channels.

The active foaming of the sludge chambers continued off and on for about three months and then gradually decreased, but even at the present time (Nov. 7), nine months after the tanks were first used, some foaming is still going on.

The only important result of the foaming, however, has been its effect on the appearance of the tanks. The tank effluent has been well clarified and the digested sludge removed from the bottoms of the sludge chambers, even as early as two months after starting the plant, has been inoffensive, and now dries readily to a spadeable condition in less than a week. The farmers are beginning to haul it away for fertilizer.

The most economical method of handling the foaming sludge which spilled over onto the surface of the sewage in the settling chambers was allowing it to stiffen for a day and then using a water spray to drive out the entrained gas, after which it would sink and pass through the slots into the sludge chambers.

Numerous schemes were tried out at various times to stop or lessen the foaming, and they afforded more or less temporary relief, but no certain remedy was found. These included (1) stirring up the deposits in the sludge chamber by means of the pressure water pipes; (2) stirring up and spraying the floating sludge in the sludge chambers; (3) withdrawing some of the partly digested sludge through the sludge pipes; and (4) resting the tanks at intervals, by shutting off the sewage.

The foaming of the Dallas Imhoff tanks is not due, so far as is known, to any special characteristic of the sewage, which is slightly septic when it reaches the plant, but otherwise is normal for a southern residential community of 140,000 inhabitants.

It may be said, however, that the tendency of some Imhoff tanks to foam, during the so-called "ripening period" in the early months of their operation, should encourage more careful attention to those fine points of design which will lessen the possible difficulties of operation during this period. Among other things, it is suggested that in some of the tanks that have been constructed in America during the past five years the capacity of the sludge chamber lying above the slots has been too small in comparison with that of the sludge chamber lying below the slots. For best results it is also desirable that the sludge chamber shall not be too crowded with pipes and partition walls, and that the area of the water surface shall be the proper size. This is more important than that the walls of the sludge chamber should extend far above the water surface. Footways or working platforms should preferably be carried around rather than across the sludge chamber opening.

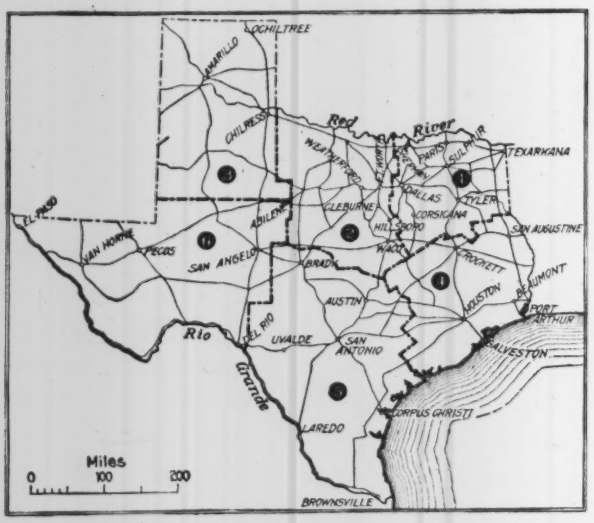
Utilize Farm Machinery on Road Work

Sand may be applied to a clay road by means of a grain drill, and clay may be applied to sand roads by means of a manure spreader, while a spike-tooth harrow may be used to remove grass and weeds from a newly-graded road or to smooth the roadway in much the same way as with a road-drag. The Missouri State Highway Department suggests these methods to the farmers as means of helping in local improvement of byways as well as of highways.

Highway Department Organized in Texas To Spend $9,000,000

Office System Devised for Handling of Motor-Vehicle License Fees, Which Will Be Spent on Roads

ALTHOUGH the Texas Highway Department was not organized until July, it has issued licenses to 200,000 automobile owners, collected $750,000 for one-half year's fees therefor, laid out a tentative state road system of 5000 miles, organized an active engineering department, and issued a manual of instructions. This manual includes details of making county road maps and bridge plans, and a system of numbering bridges and culverts.



MAP OF 26 THROUGH ROUTES ADOPTED AS STATE HIGHWAYS IN TEXAS—SYSTEM IS DIVIDED INTO SIX DISTRICTS

The state-road system laid out by the department, as shown on the accompanying map, includes 26 different routes aggregating 5000 miles. This map shows also the six districts into which the system is divided for supervision of the construction work.

The organization of the department consists of two bureaus—engineering and registration. At the head of the former is the state highway engineer, George A. Duren. The latter is headed by the secretary of the department, D. E. Colp.

Engineering Organization Not Yet Complete

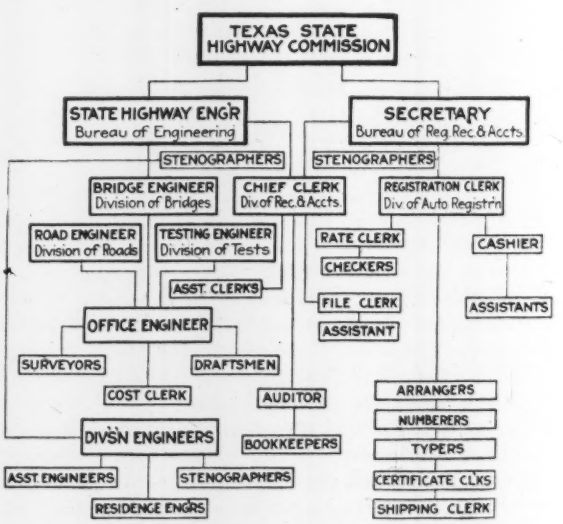
The engineering bureau is beginning already to get in touch with the county officials and engineers. The accompanying organization chart shows that this bureau has three divisions: Roads, bridges and tests. The first undertakes the solution of road construction and maintenance problems. The second division designs the bridges and supervises their construction. The third division handles the testing of all materials entering into both roads and bridges. The central engineering office is in charge of an office engineer, Julian Montgomery, who handles also the assignment of surveyors and draftsmen.

For the inspection of construction the state is divided into six divisions, with a division engineer in charge of each. Only one man has as yet been appointed, M. C. Wellborn, formerly city engineer of Austin, but the staff will be completed as the activities of the counties increase and their applications for aid are entered. In many cases personal contact by the division engineer or other official is all that is necessary to start the county officials on a construction program. Resident engineers under the division engineers will probably not be appointed for a time, as the duties may be assigned to the county engineer as long as he reports to and is accountable to the state highway department. It is his duty to prepare a county map and to make location surveys, plans, profiles and estimates of costs.

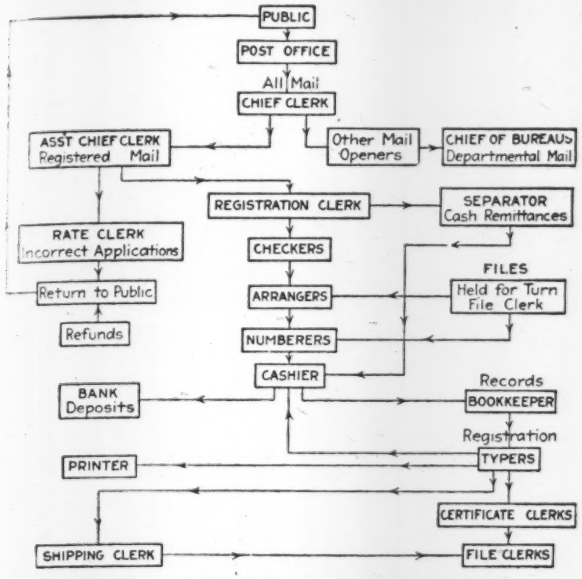
Construction Program is Large

Some idea of the aggregate magnitude of the work may be gathered from the program of the bureau of engineering, which is planning for an expenditure of $9,000,000 in five years. Of this amount the Federal Government will supply $4,515,750. The state's share of the $9,000,000 will be provided entirely from the licensing of automobiles and other motor vehicles. The license fees are 35c. per horsepower for automobiles, and range as follows for commercial trucks: $20 for a carrying capacity of ½ to 1 ton per wheel; $40 for 1 to 2 tons; $60 for 2 to 3 tons; $150 for 3 to 4 tons; and $300 for 4 to 5 tons. Above 5 tons per wheel an additional $500 will be charged for each 1000-lb. increase. No load greater than 800 lb. per inch width of tire per wheel will be permitted, and no vehicle having a total gross weight of more than 14 tons will be licensed.

Collection of the license money, 50% of which must be returned to the counties, was the first and immediate work of the department. For this purpose a large group of clerks had to be employed, numbering 60 at the time, as the rate of handling when fully organized reached 3500 applications daily. The procedure followed in the registration of the applications and fees is shown in the second of the accompanying charts.



ORGANIZATION CHART OF THE TEXAS HIGHWAY DEPARTMENT



PRESENT ORGANIZATION FOR REGISTRATION OF LICENSES IN TEXAS HIGHWAY DEPARTMENT

Analysis of this organization by an engineering economist, A. L. Luedke, of the U. S. Office of Public Roads, indicated that there was too much diffusion of responsibility and money, but in the main the scheme of organization was satisfactory. He established simple checks on the existing system and made suggestions for handling next year's work. These are outlined in the third chart. The principal changes relate to the new positions of the separators and the cashier. By this method, if adopted, the former will handle the cash remittances direct to the cashier and the latter will receive cash and other remittances before they go to the arrangers.

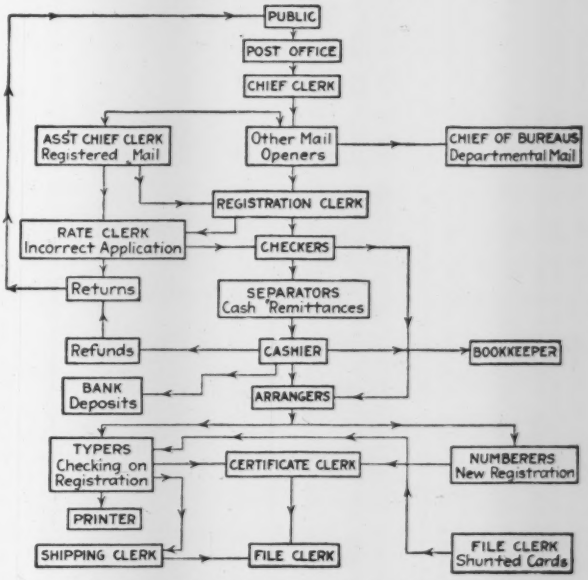
To reduce the work of the office force it is planned to have the applicant virtually make up the office records. For this purpose the registration cards, 4¼ x 10 in., will be so printed as to allow for cutting into four parts for different uses, as follows: A dummy remittance card, giving information as to car and owner; an index card, to be used to check against the old registration typewritten sheet so as to correct registration of previous year or to note transfer of ownership; an index card by name, to check up present index by name; and fourth, a certificate to be returned to the owner when registered. The certificate will be designed so that it is necessary only to place a stamp on back of card and mail to owner, the address having been written by the applicant.

Under the old plan, an average of 500 certificates could be issued per day per clerk, requiring 500 working days for a total registration of 250,000 expected next year. By the proposed plan, the saving will be about $600, allowing $400 for the handling of the mail and sorting of the certificates. It is estimated that with the method of stamping the original record the number of typists can easily be reduced from 14 to 6, for it is not considered necessary to retype the original list each year.

Even this year, when everything was new, some economies were effected as, for example, in the method of typing the registration list. Ten registrations are put on a sheet of letter-size paper in two rows, the digits 1 to 0 always appearing in the same relative positions. A face copy and four carbons are made for use as follows: The face copies are bound up in book form for file. The first carbon provides a label address to be pasted on the envelope returning the registration card and metal seal. This work is done by contract at 50c. per 1000. No. 2 carbons are bound up in loose-leaf books and go to the state printer to make up a directory for the use of county clerks and chiefs of police.

No. 3 carbon is used first to make up a shipping list for numbers, which are shipped not to individuals, but in lots to some garage owner, road enthusiast, or official in the town. To the distributor is sent his quota of names from the No. 3 carbons. The last carbon, No. 4, is a general utility list and may be segregated according to type of car or engine numbers for quick reference in case of stolen vehicles.

Another economy was in the sending out of the round pressed metal seals and registration cards as first-class



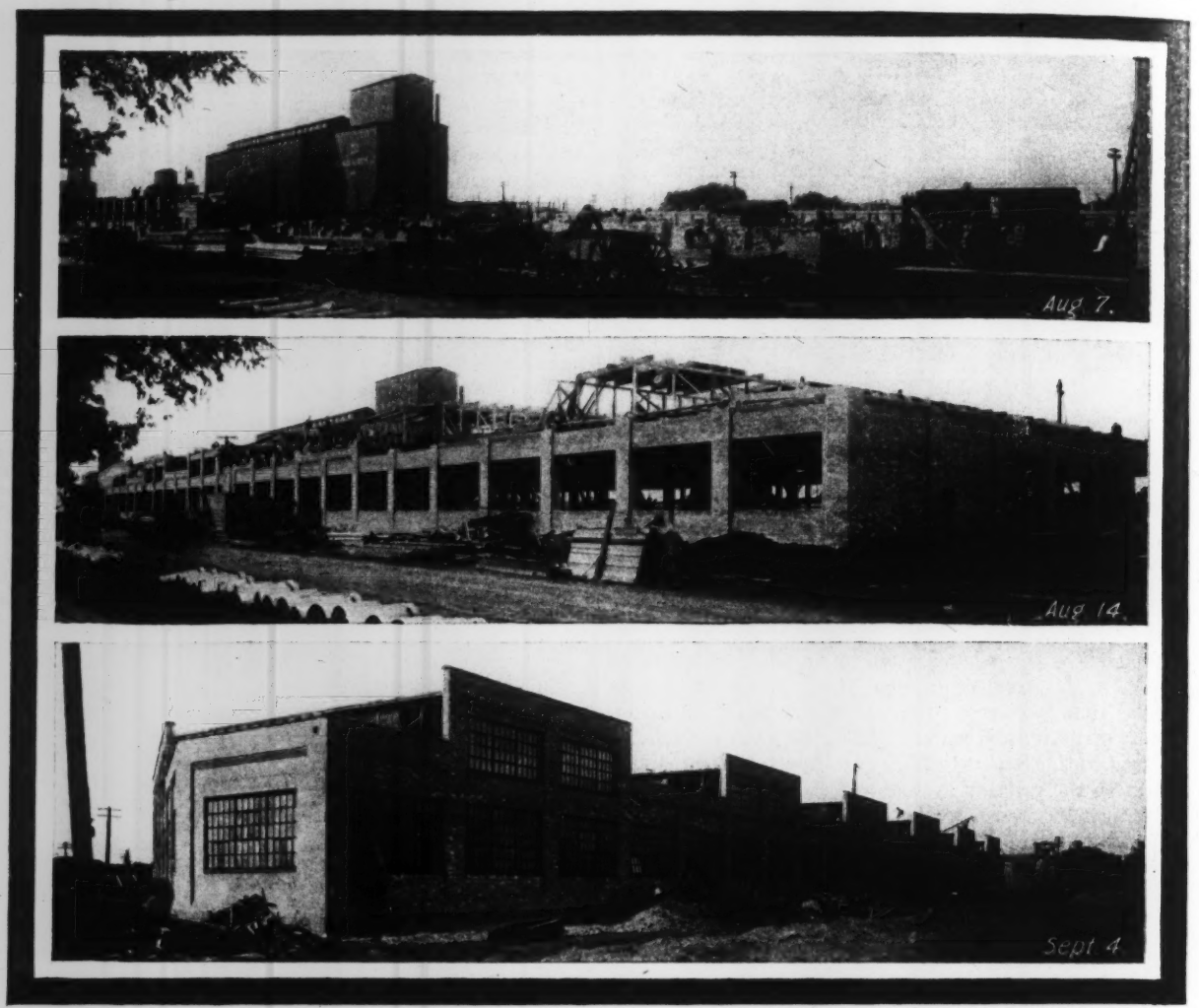
PROPOSED ORGANIZATION FOR REGISTRATION OF LICENSES

mail. The total weight came so near the 2-cent limit that a sheet of instructions, even on the thinnest paper, could not be added. These instructions were therefore stamped on the back of the envelope. Motorists are to retain old numbers but must have new seals each year.

The personnel of the commission, appointed by the governor, is Curtis Hancock, chairman; Thomas R. McLean and H. C. Odle.

Speeding Up Ship Program

With the coöperation of the lumber industry, the Emergency Fleet Corporation's program is being speeded up. It is said that within a short time a ship a day will be put in the water by the United States at yards along the Atlantic and Gulf coasts, in addition to almost as many wooden vessels now being built for private interests. The Pacific coast will also contribute about 200 standard-type wooden steamers.



AUG. 7, WALLS BEGUN—AUG. 14, WALLS FINISHED, ROOF IN PROGRESS—SEPT. 4, BUILDING COMPLETED

Machine Shop Is Erected in 40 Days

ERECTION of a machine shop 132 x 432 ft. in 40 days has been accomplished at the plant of the Minneapolis Steel & Machinery Co. in order to facilitate its work on munition contracts for the U. S. Government. The building is mainly one story high, with six second-story bays. It has concrete footings, brick walls and steel interior columns. I-beam roof girders support wood joists and sheathing covered with felt and asphaltum roofing. About half of the floor is of 6-in. concrete, the balance having creosoted wood blocks on a concrete base. Steel sash is used for the windows in the main walls and the transverse clerestory roofs of the second-story bays. The quantities were about 300,000 brick, 1500 yd. of concrete, 175 tons of structural steel, and 400,000 ft. b.m. of lumber.

Placing of 1500 yd. of fill was begun July 25. On Aug. 7 the concrete foundation and floor had been placed, and bricklayers were at work on the walls. The walls were completed for the main floor by Aug. 14. On Aug. 28 the second-story bays and roof were completed, and the steel sash was being placed. The building was completed ready for painting Sept. 4, at which time part of the machinery had been installed.

Light hand derricks were used in the erection of the roof framing. The force during the different stages of the work averaged 50 men for concreting, 30 bricklayers, 25 men erecting the steel, 50 on the roofing, and 10 on the steel sash. The building was designed and erected under the direction of J. B. Gilman, chief engineer, and A. M. Burch, construction engineer for the company. The work was done by day labor.

Typhoid Data in Ten Largest Cities

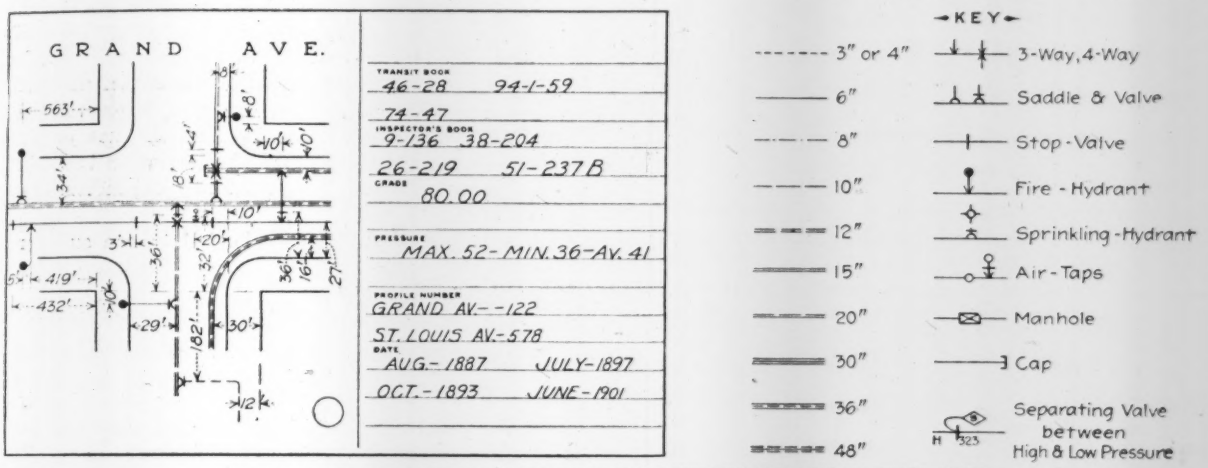
Typhoid death rates in the ten cities of the United States with populations in excess of 500,000 were as follows in 1916: New York, 3.85 per 1000; Chicago, 5.12; Philadelphia, 7.49; St. Louis, 9.38; Boston, 3.44; Cleveland 5.34; Baltimore, 18.15; Pittsburgh, 8.63; Detroit, 15.22; Los Angeles, 2.78. Rates for all causes in Detroit are high, 19.25, because of the under-estimation of its population by the U. S. Census Bureau. Los Angeles has an abnormally low record of all deaths, 12.35. It is a "young" city and has only recently passed the 500,000 mark. Baltimore has filters and still is the highest in typhoid. Flies doubtless carry the germs there.

Location of Water Mains, Connections and Valves Kept on Card File

ANY card system of keeping records which has proven its value by twenty years and more of continual use, without radical change, is worthy of notice. In this class falls the card system for recording the location of water mains, valves, connections, fire hydrants and other special fixtures, which is in use by the Water Department of the City of St. Louis. This system comprises the use of specially printed 4 x 6 cards kept in drawers and referred to ordinarily only by members of the office force of the distribution system. The accompanying illustration gives a very clear indication of the nature of the card and the information kept on it. Each size of pipe and each particular fitting has a special symbol, and the situations of all valves are marked, showing their position with reference to the curb or building line.

The street running from bottom to top is an east and west street, and from left to right, a north and south street. The east and west streets follow each other alphabetically in the drawers; that is to say, Atlantic Ave. would come before West Ave., and all intersections with north and south streets are represented by succeeding cards which start from the most easterly intersection of the east and west street with a north and south street. Therefore, to locate any intersection it is necessary only to know which of the streets is an east and west street.

Each card is inclosed in an envelope of transparent paper, which keeps it from being soiled by the rather excessive handling to which cards of this sort are subjected. It is only possible to take the cards from the drawer by unlocking a special keeper-rod, the key to which is guarded carefully and is never allowed to leave the possession of the chief draftsman of the water department.



LOCATION OF ALL PIPES IN CITY READILY DETERMINED FROM THIS CARD

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

Human Interests Predominate in Kansas City Engineers' Club

NO HOME, no official publication and no stated meetings—yet the Kansas City Engineers' Club of 250 members is a success. The best engineers of all groups belong to it and at least 75 members turn out for its ordinary monthly meetings, which are held at the University Club. At the annual banquets there is virtually a full attendance. The meetings usually take the form of evening dinners or smokers at which there is plenty of singing by the members, with some cabaret attraction. The occasion of the meeting is usually a talk of more than ordinary interest by some engineer or layman. Maj. Gen. George W. Goethals, Ex-Governor Hadley or H. M. Waite, city manager of Dayton, Ohio, are men the club likes to hear. Local men appear only when they are handling work of unusual interest or after having passed through some unusual experience.

Engineers, 25 years of age and of good character and satisfactory professional standing, are eligible. Non-engineer admissions are limited strictly to 20% of the total membership. The executive committee and secretary reclassify the membership from time to time to keep the committee on admissions informed of the number in each group. The annual dues are $5, with a special charge for those attending each meeting.

The success of the club, in the opinion of most of its members, lies in the fact that human interests rather than technical matters predominate, also that the most prominent engineers have taken an active interest since its start. An *esprit de corps* has been generated and the members feel they are part of a real unit of 250 live engineers who have materially strengthened the engineer's standing and influence in the city.

H. G. Hunter addressed the first meeting of the season, Nov. 9, a smoker attended by eighty, relating his experiences connected with erection work at Rostov, Russia. Lieutenant Simine, of the Canadian army, told of his repeated journeys "over the top."

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Areas of Segments of Circles

Sir—In your issue of Nov. 8, p. 894, the letter of Leopold Pistner shows how the trancendental formula for the area of a segment of a circle may be replaced by a converging series. The present writer had already gone through this mathematical investigation in his search for a rational basis for the Molesworth formula, to which attention was called by him in your issue of Oct. 4, p. 657; but no form suggestive of the latter formula had been reached.

Evidently Mr. Pistner's letter was written before the appearance of the writer's, mentioning the Molesworth formula, or he would have noticed that, with three terms taken of the converging series, the results reached are far inferior in accuracy to those of the Molesworth formula; the latter involving nothing more troublesome than one square and one square root, whereas the former contains the three fractional powers whose indices are $\frac{3}{2}$, $\frac{5}{2}$ and $\frac{7}{2}$. With four terms taken of the series, probably the resulting accuracy would equal, if not surpass, that of the Molesworth formula; but the additional term involves the power of index $\frac{9}{2}$.

One object of the writer's letter of Oct. 4, was to call forth, if possible, some information as to the history and foundation of the Molesworth formula.

I. P. CHURCH,
Professor of Applied Mechanics and Hydraulics, Emeritus, Cornell University.
Ithaca, N. Y.

Are Fine Screens Needed for the Activated-Sludge Process?

Sir—Reading the abstract of Mr. Hatton's paper, recently presented at the American Public Health Association's convention in Washington, entitled "Conclusions on Activated-Sludge Process at Milwaukee," and published in your issue of Nov. 1, any one who is watching closely the development of the activated-sludge process is impressed with two points—namely, the progress being made at Milwaukee in solving the sedimentation tank problem, and the intimation that a fine-screen installation is desirable as a component part of the proposed activated-sludge plant.

There is a statement at the end of the first column of the article to the effect that "sewage from an industrial community should be fine-screened before passing into the aërating tanks."

Further along in the article there is also the following statement:

"We found at Milwaukee that we could save from 15% to 20% air when treating a sewage passing a 20-mesh screen, as compared with the same sewage passing a 1-in. grid screen."

I am a little confused, as in the former statement particular emphasis is placed on the fact that this conclusion is based on the author's "observations," covering two years, while in the latter statement the word "found" is used.

I believe no advantage is taken if Mr. Hatton's statements were interpreted to mean that fine screens are desirable at Milwaukee, even if the cost of accomplishing their work was high. Their desirability seems to embody the idea of smooth plant operation. The developments along sedimentation tank lines are appreciated, and particularly as they apply to recovering a sludge with the lowest moisture content that is practicable. However, since the Cleveland activated-sludge unit has been operating almost continuously during the past two years and there has been no evidence to indicate that fine screens instead of bar gratings are desirable, I am, therefore, much more concerned with the latter point. My desire for more information is further emphasized by the fact that the use of fine screens instead of bar gratings at Cleveland's two lake-front plants involves an additional expenditure of $500,000.

I also believe that the Cleveland data are sufficient to warrant their being given considerable attention, and for the following reasons:

1. That the Cleveland unit was the first to be designed and operated where the degree of purification involves simply clarification.

2. That this plant was the first to operate having aërating tanks with the saw-tooth bottom and the sewage flowing crosswise to the air diffusers.

3. That present data indicate that perforated pipes as air diffusers can be depended upon.

4. That the idea of using glass buildings, similar to hot houses, over sludge beds was first developed at the Cleveland testing station.

5. That the city has tested, during a nine-month period, a sewage screen with $\frac{1}{32}$-in. slots when treating an average daily sewage flow of 5,000,000 gallons.

Since I have read the second and third reports of the Milwaukee Sewerage Commission with the purpose of securing information about the accomplishments of fine screens, I would like to take the liberty of asking Mr. Hatton the following questions:

1. Did the 15% or 20% saving of air apply to the process when the purification involved clarification or when the treatment was carried to the point of nitrification?

2. Will the total annual saving (fixed and maintenance charges) affected by the 15% or 20% reduction in the quantity of air required be sufficient to offset the identical charges pertaining to a screen installation?

3. Will Mr. Hatton tabulate in such form as to compare the quantity of screenings removed by the 1-in. grids and the quantity removed by the 20-mesh screen?

GEORGE B. GASCOIGNE,
Cleveland. City Sanitary Engineer.

[Copy of Mr. Gascoigne's letter was submitted to T. Chalkley Hatton, chief engineer, Milwaukee Sewerage Commission, whose reply follows.]

Sir—Answering George B. Gascoigne's queries 1, 2 and 3, I beg to submit the following:

1. All of our investigations have been made with a

view to obtaining a stable effluent; we have therefore been concerned in clarifying the liquor to that end only. Cannot therefore answer the question.

Questions 2 and 3 may best be answered together. To do this I will quote from my latest report to the Sewerage Commission, dated Aug. 15, as follows:

"During the past months, especially since we have revised the diffusers in our plant on Jones Island, the indications have been more and more pronounced that fine screening preliminary to aëration would be advisable if the process is to be satisfactorily operated.

"The character of sewage produced in Milwaukee creates in the aërating tanks large masses of hair, lime, entrails, leather finding, pieces of hides and bark; these are constantly deposited upon the surface of the diffuser plates, interfering with their efficiency and stopping up the orifices to the sludge pumps.

"Much of this mass is inorganic matter which adds nothing to the richness of the activated sludge, and should never reach the aërating tanks; much is organic matter in such large particles, and of such a character, as to be little changed by the process, and some of it, while being organic, can add just as much nitrogen to the final sludge produced by being passed direct through the dryer as though it had first passed through the treatment tanks, and a large proportion of air necessary to partially reduce this organic matter to ammonial nitrogen would thus be saved.

"From data obtained at the testing station after more than two years' observation the following production of screenings may be expected from the Milwaukee sewage:

1930 Period	Flow m.g.d.	Tons Coarse	Tons Fine	Tons Total	Tons Dried Sludge
Min. flow	60	10	35	45	10
Average flow	85	14	51	65	14
Avg. with storm flow	86	14.2	52	66.2	15
Storm water flow	165	28	98	126	28

Coarse screens, 1-in. grids. Fine screens ½-in. slots.
Screenings 80% moisture. Dried sludge 10% moisture.

"From the preceding table it appears that during the 1930 period an average of 15 tons of dry sludge would be produced from the screenings. Of this about 12 tons are produced from the fine screens. Estimating the cost of dewatering, by pressing, from 98.5% to 80% moisture as $4.82 per dry ton, the daily average saving in favor of fine screening would be $53.84 or $19,652 per annum. At 10½% for interest and depreciation this represents a capital investment of $187,162.

"Assuming 10% of air can be saved by installing fine screening (and our investigations indicate from 15 to 20%), and that it will require 1.5 cubic feet of air to treat a gallon of sewage, the annual saving for the 1930 period would be $11,771, representing a capitalization of $112,105.

"Therefore, from the best evidence before me the overheads saved by fine screening would amount to $31,423 annually, representing a capitalization of $299,267.

"From the table appearing in the appendix to this report the estimated cost of the fine screening plant is $227,615, and the cost of operating the same, exclusive of overheads, is $0.23 per million gallons or approximately $7000."

From the above it would appear that coarse and fine screening would break about even, but aside from this is the advantage of "smooth plant operation," as Mr. Gascoigne has so well stated it, which, to the operator, means success or failure in the activated-sludge process. Throughout our entire experiments upon each type of tank nothing has given us so much annoyance and caused as frequent shutdowns as the accumulations of masses of sludge upon diffuser plates, in settling tank bottoms, draw-off pipes, valves and pump runners. Upon a large plant this would mean increased operating expenses and increased tankage.

For at least eighteen months the writer disagreed with every member of his staff as to the necessity of fine screens, but the evidence was so conclusive that he was forced to acquiesce.

T. CHALKLEY HATTON,
Chief Engineer, Sewerage Commission.
Milwaukee.

Determining Meridian by Means of Solar Shadows

Sir—One would gather that the method described in the article entitled "High Accuracy in Determining Meridian by Means of Solar Shadows," in the issue of Nov. 15, p. 932, was an original or at least an uncommon method, and one which for accuracy was to be compared favorably with the methods of determining the meridian by observation on Polaris. As a matter of historic interest, it is worth noting that this method of determining the meridian by equal altitudes of the sun is one of the oldest of which we have record.

A mathematical study of the method will show that for certain seasons of the year, leaving errors of observation out of consideration, one might expect an error of 0.05′ or more, due to change in the declination of the sun between the times of observation. This error would, it seems to me, be small as compared with the accidental errors of observing under the conditions described. To me it would seem unlikely that, for the length of staff and other conditions described, the probable error of the meridian determination would be less than 30′ or, say, roughly $^1/_{30}$ of the precision that might easily be attained by observation on Polaris, and although "high accuracy" as a term is rather meaningless unless qualified, from the standpoint of the engineer it would seem that its use in the article referred to was in a sense an abuse.

R. E. DAVIS.
Associate Professor of Civil Engineering, University of Illinois.
Urbana, Ill.

Sir—J. A. MacDonald's article in your issue of Nov. 15, p. 932, was interesting, but it would have been much more so if he had stated the precision obtained or how successive trials agreed with one another. There are so many probabilities of making errors in the method described that it seems to the writer very crude.

In the first place, the space used must be not only flat but absolutely level. In case one point is only a few inches higher than the other—less than would be detected by the eye—the time at which the shadow would cross the arc of the circle would be materially changed. This would make an appreciable error in the North line as only ⅛ in. difference in the location of the cross point

would make $\frac{1}{16}$ in. error in the bisector. In addition to this, the exact point of the shadow is hard to trace. On a surface such as a concrete walk it is difficult enough, and on a dirt surface, with the line scratched by a nail, it is much more so. Again, if the nail is not held exactly plumb the circle will vary quite appreciably.

Assuming, however, that the two points are located absolutely correctly it becomes an extremely difficult operation to transfer this line to a system of survey lines. To begin with, we have a base only about six feet long. I take it for granted that the instrument is to be set up on the chord of the circle. The sight is probably taken on the top of the pole. Presumably, the line has to be thrown backward by inverting the telescope and here we have the adjustment of the transit entering in, the very thing Mr. MacDonald was trying to avoid. In case we remove the pole and sight forward, there is no check on the only sight used. If the sight is taken on the bottom of the pole the adjustment of the instrument again enters into the problem. Also the alignment of the pole must be perfect. It must be remembered that an error of only $\frac{1}{16}$ in. in any place will make a difference of several minutes in the North line.

There are other things to be taken into consideration. The line in the dirt must remain intact for several hours. The pole must not be touched for the same length of time. A cloud over the sun for only a few minutes at the critical time in the afternoon causes the loss of the whole day, or a stiff breeze may spoil the whole operation. And it must be borne in mind that a six ft. base is an extremely short base from which to work, with the best of conditions.

If all these chances of error are considered it appears to the writer that the old method is the best. It takes but little, if any longer, can be made when the party is not otherwise engaged, and when done properly is bound, without any doubt, to result in the necessary precision.

CHAS. M. BELL.

Woodcliff, N. J.

Practice in Through-Girder Kneebraces

Sir—A query as to top-flange column length of through girders, and the design of the kneebraces by which the flange is stayed, appeared in your issue of Sept. 6, p. 470. It seems to be the usual practice among designers to assume that these gussets do brace the top flange sufficiently, making the distance between gussets the column length L in the formula $p = 16{,}000 - 200\frac{L}{B}$.

The size of the inclined angles of the kneebraces is usually fixed by arbitrary choice or judgment based on past experience, just as the size of sway bracing for through bridges or the size of girder web stiffeners is assumed. The results obtained are perfectly satisfactory. In a great number of designs for railway bridges examined, $3\frac{1}{2}$ x $3\frac{1}{2}$ x $\frac{3}{8}$-in. angles were found to be used for these inclined angles, almost without exception.

A careful study of a dozen of our up-to-date textbooks on structural design showed that in six of them nothing was said about these kneebraces. In five others, a very brief description was given, merely stating that the object of such kneebraces is to brace the top or compression flange. In the remaining one, Thayer, Vol. 2, pp. 37 and 86, a method of design is given. The side thrust of the top flange per panel length, produced by the tendency of this flange to bend in a horizontal plane is taken as one-tenth of the short-block compressive strength of the top flange, divided by the number of panels in the span. To this thrust per panel is added the wind load per panel on the upper flange, and the whole is applied at the upper end of the kneebrace. The brace is then designed as a vertical cantilever girder, the inclined angles forming one flange and the main girder stiffener angles the other flange.

Cheltenham, Penn. CHARLES D. CONKLIN.

Specially Ruled Sheets in Drafting Room

Sir—Referring to the article entitled "Specially Ruled Sheets Have Wide Use in Drafting Rooms," by R. T. Dana, which appeared in *Engineering News-Record* of Oct. 25, p. 799, I would suggest a remedy by means of which the obliteration or removing of a ruled line by erasing may be avoided.

If paper thin enough for blueprinting is used and the section lining is sufficiently heavy, these lines may be readily seen from the back of the paper. If, therefore, the back of the paper be used for drawing purposes it is apparent that erasing will not injure the ruled lines unless a hole is made through the paper. For this purpose an onion skin paper, while expensive, is eminently satisfactory, it being tough and standing a lot of handling, and erasing injures it but little.

F. G. SWITZER,
Assistant Professor, Mechanics of Engineering, Cornell University.
Ithaca, N. Y.

Should Engineer or City Council Decide What Material To Use?

Sir—The letter of H. S. Morse, in *Engineering News-Record* of Oct. 18, p. 756, relating to the question whether the engineer or city council should "decide what material to use," brings up for consideration a matter which is of vital importance to the engineer. It has to do with the attitude held by the general public regarding his worth, as well as with the recognition of his peculiar qualifications. Just as a city council will fix the kind of material of which a pavement or sewer is built, so will the ordinary manager or superintendent of an industrial plant attempt to dictate to the engineer, and the engineer has no recourse. If the judgment of the manager is in error the engineer is sure to be blamed for failure, while the manager takes all commendation in case the material or method chosen proves proper and satisfactory. In either case the engineer has been relieved of responsibility in the matter.

I will state three cases in my own experience which have been humiliating to me, and no doubt other engineers can give similar instances of interference with the work for which engineers are supposed to be employed. Some seven years ago I was placed in charge of construction of certain work for a mining company in Mexico. Two buildings had been ordered built of adobe by instructions from the superintendent, in spite of the fact that in both cases moving machinery and

shafting were to be installed. All suggestions to change the material fell on deaf ears. The result was that the adobe walls failed, due to the shock. Who was to blame?

While in the employ of a cement company a few years ago, I was given charge of the construction necessary for the replacing of several miles of cast-iron pipe for steel riveted pipe which had deteriorated badly and was bursting in innumerable places. Without referring the matter to me an order was made out for a certain quantity of 10-in. cast-iron pipe, the order being placed with the understanding that the quantity required would be changed later to conform with the engineer's estimate. It was found after installation that a 12-in. pipe should have been used to secure the required discharge. I was promptly accused of making a wrong recommendation and was struck by the superintendent when I expressed my opinion in the matter. Who was to blame?

In another instance, while employed by a certain smelting company I was supervising the construction of some heavy foundations. A pier footing which carried a very heavy load had been laid out and the foreman was instructed to center the pier over the footing. It was found necessary to move a large wooden drain, as it had been constructed on the footing area. After a portion of the drain had been moved the superintendent of the plant gave instructions to stop shifting the drain without referring the matter to the engineer in charge of the work. The result was that the pier was cast off the footing center. The ground had been broken up by blasting during the original construction work and was well saturated with water from the drain. Unequal distribution of loading was therefore dangerous. Who was to blame?

What can the engineer do to protect himself in such cases? Instead of taking a leading part he is forced by circumstances to follow the requests and demands of men not qualified to direct work, but who hold the whip hand, being in the position of employers. This trouble is most apparent in corporations. Where is the trouble—is it in the engineer himself, in his training, or in the general attitude? Can coöperation among engineers which tends to improve their political and social status help in the solution?

E. G. SHEIBLEY,
Riverside, Calif. Civil and Sanitary Engineer.

Paving of Parkway Drives and Boulevards

Sir—In his article on park driveways in *Engineering News-Record* of Oct. 18, p. 746, Mr. Whinery says:

"It will be noted that recently many engineers of experience in this line of work require that the concrete shall be thrown open to travel for some months or even years before the bituminous coating is applied. The rationelle of this practice is obviously to secure the roughing of the surface of the concrete so that the bituminous coating will adhere to it. Why not secure this effect at once by the treatment here suggested?"

The roller treatment favored by Mr. Whinery, followed by a belt, is probably the best concrete road finishing practice today and, if the concrete be placed at the stiffest consistency that can be handled, will give a smooth and dense surface with less cost than hand-troweling. But the article referred to condemns the troweling of the base to obtain a smooth, dense and impervious surface. I consider the clean, hard surface of hand-troweled mortar the one advantage of the two-course pavement. If properly cleaned and dry, there is less chance of the coating ever parting from it than any rough-finished concrete, where the engineer puts his faith in an apparent mechanical bond, as anyone can testify who has tried to remove the asphaltic oil from a clean curb face.

The principal cause of the parting of the asphaltic carpet is the failure of the surface bond in the concrete. A thin skin of mortar is found on the under side of almost all the parted oil cake or carpet, showing that the adhesion of the coating is sufficient, ordinarily, to remove the surface of the base. This weak surface skin is most noticeable with wet mixtures and most nearly eliminated in the "sidewalk-finished" base. It can be removed by the treatment mentioned by Mr. Whinery, exposure of the concrete to traffic for several years; then, if desired, the bituminous surface may be applied.

Because of our excellent and cheap natural asphaltic oils, California engineers have experimented further with the surfacing of concrete roads than they would under Eastern conditions, but the tendency now is to build the concrete base so well that the bituminous "wearing coat" becomes unnecessary, thus dispensing with the added cost of construction and the continual maintenance of the carpet. Such a road is cheaper, smoother and almost free from wear and maintenance.

Monrovia, Calif. E. EARL GLASS.

Rapid Methods for Accurate Calculations

Sir—In this age, when young engineers are working under pressure, it is painful indeed to watch the arithmetical methods used by those unacquainted with the following simple time savers:

Additions—With the several quantities placed in vertical columns, certain digits always can be grouped mutually, usually in pairs totaling ten, which totals are summarized more easily and quickly than a greater number of figures of different denominations. Often it is advisable to pass in its consecutive order a certain figure which, however, should be picked up before it is forgotten. Briefly, in the addition of many figures, one should aim, when running down a column, at securing as often as possible a total ending in zero.

Multiplications—Here again the benefit of the digit zero comes into play. Take for instance the multiplication of 32 by 98. It is a comparatively simple matter to multiply 32 by 100 and from the result deduct the product of 32 and 2. Again, suppose we desire to multiply 25 by 96. Here we make use of the fact that 25 is ¼ of 100 by dividing 96 by 4 and multiplying the result by 100.

The writer appreciates and is heartily in sympathy with the ever increasing uses of the slide rule and the adding machine, but he does not sympathize with the enthusiast who reaches out for his slide rule and actually wastes time performing the operation.

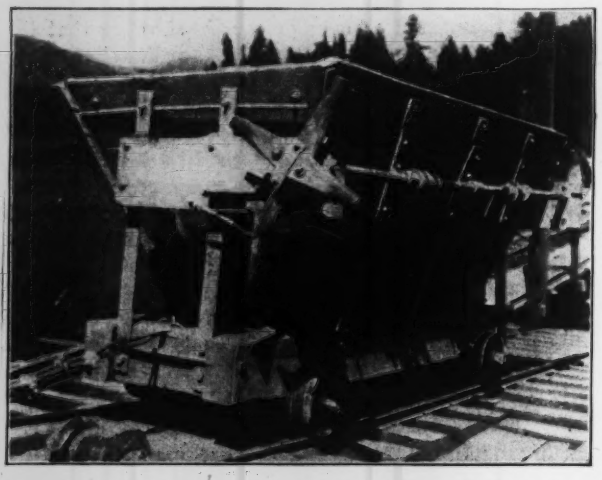
Cleveland. H. S. JACOBY.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

A Home-Made 6-Yard Dump Car

IN THE work at Huntington Lake, Calif., where 135,000 yd. of concrete are being placed on rush schedule, all of the cars which handle sand and gravel are of 6-yd. capacity. In order that the cars used on the inclines might equal the capacity of those handled by steam locomotive on the main line tracks, some 6 cu.yd. bottom-dump cars were built up in the company's shops.



HOME-MADE 6-YARD CAR WITH BOTTOM DUMP

These cars, as shown in the accompanying illustration, are of wooden construction, being simply a hopper with hinged bottom mounted on a solidly built wood truck reinforced with ½-in. strap iron. The bottom is tripped by a lever operated from either end of the car and is returned to place by a pair of cables which wind up on the longitudinal pipe serving as an axle and are operated by the ratchet hand wheels at either end.

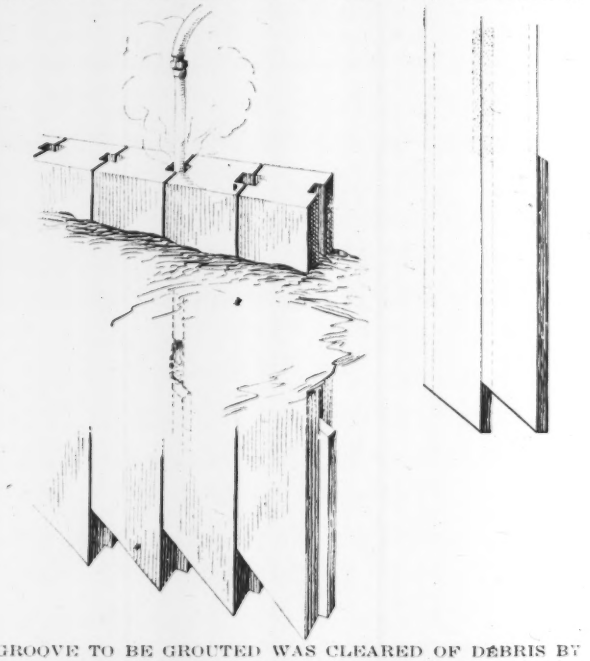
The large capacity of these cars has been a material advantage in hastening the work and the bottom-dump scheme has given the maximum speed with a rigidly built car body.

A general description of the work of raising the three dams on Huntington Lake, which is under the direction of R. C. Starr, hydraulic engineer of the Southern California Edison Co., appears elsewhere in this issue of *Engineering News-Record.*

Cleaning Concrete Sheet Piling Grooves with the Steam Jet

STEAM under 200 lb. pressure was found to be the very best way of cleaning out the débris from the slot formed by the opposing grooves in adjacent concrete sheet piles which were designed to be filled with grout to make the job tight. The construction of these piles can be seen in the accompanying illustration, which shows also the 5-ft. guiding tongue at the bottom and the wedge-shaped point of the pile, which was to keep the following pile snug up against the one driven just before. The tongue, of course, followed in the groove of the preceding pile, and was expected to clean out this groove.

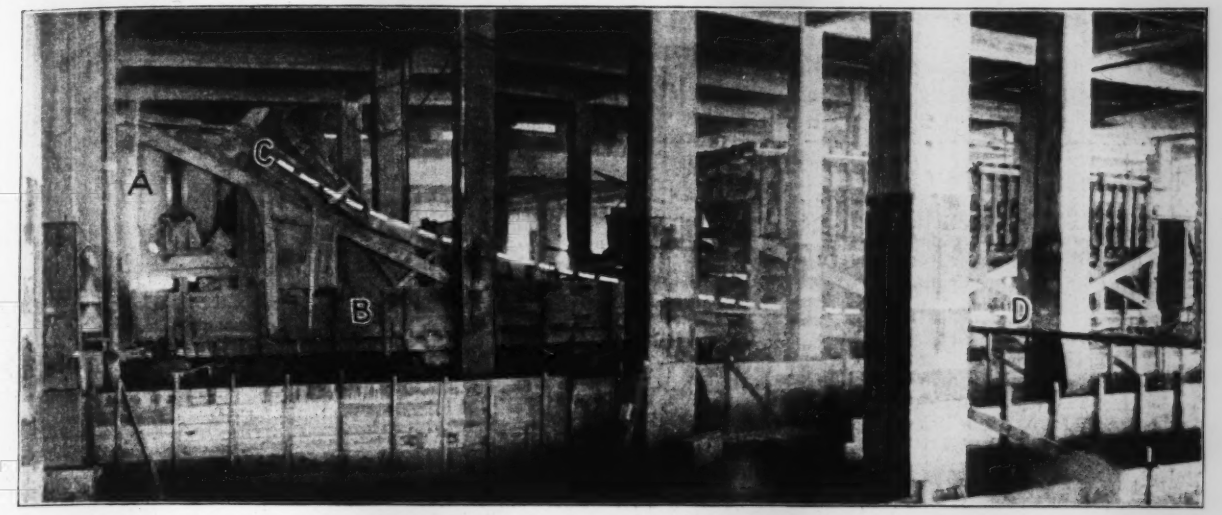
In spite of the care taken to prevent the entrance of débris, many of the slots were completely choked before the grouting could be attended to. The removal of this débris presented a problem of many difficulties, and though several methods were tried, no one of them proved of any value until the contractor hit upon the idea of using a steam jet for this purpose. By using steam from a locomotive which could be spared occasionally from work in another part of the job, steam was delivered at 200 lb. pressure through a ¾-in. pipe which was so rigged that it could be raised and lowered in the groove. A considerable quantity of water was used with the steam when the cleaning was started, and this helped to loosen the material, which was then expelled by the dry steam. The work was done by Teichert & Ambrose, contractors, Sacramento, Calif., and was part of a continuous curtain wall of concrete sheet piling, 2085 ft. long, built for a bypass weir, near Sacramento.



GROOVE TO BE GROUTED WAS CLEARED OF DÉBRIS BY STEAM UNDER 200 POUNDS PRESSURE

Portable Concrete Plant Builds Freight Station Platforms

PLATFORMS in the new Pennsylvania freight terminal in Chicago are being built from a portable concrete plant having a daily capacity of 150 cu.yd. The ground floor is well provided with tracks, so that it is



MIXER AND BINS MOUNTED ON ADJOINING GONDOLAS
Skip car travels as shown by dotted line, from beneath bins D over mixer car B to hopper C, where it discharges into mixer A

easy to cover its entire area. A two-car portable plant was therefore devised by the contractor. On one car is a ¾-yd. Lakewood mixer and skip-car incline, and on the other are storage bins under which the skip passes to receive the charge of sand and coarse aggregate. Cement is added from cars on a nearby track through a one-batch hopper at the end of the mixer car. Two bin-cars are provided, one being loaded outside the station, while the other serves the mixer. A number of openings are provided in the storage bins, so that substantially the whole charge of the bins comes into the skip without shoveling. Thus the crew is reduced to as few men as would be required for an ordinary stationary plant of the same capacity. A. S. Armstrong is the superintendent for C. W. Rosenthal & Co., contractors for the concrete work. The George A. Fuller Co. is the general contractor.

Motor Trucks Loaded by Steam Shovel Do Well on Hotel Excavation

By O. L. Davis
Omaha, Neb.

IN REMOVING 9500 yd. of dirt and 1000 yd. of old masonry for the basement excavation for the Conant Hotel in Omaha, motor trucks loaded by a ¾-yd. revolving shovel which part of the time used a grab bucket took out the material for $1.40 per yd., with a two-mile haul.

The main basement, 66 x 132 ft., averaged 14 ft. deep, while the sub-basement, irregular in shape, has a floor area of 3000 sq.ft. and extends 15 ft. deeper. The steam shovel began at one corner and dug itself down on an incline, which was paved behind it with heavy planking. The motor trucks were backed down to receive their loads and hauled out under their own power with the assistance of a hoisting engine. As the street which the trucks entered on leaving the lot was narrow and congested, the block at the top of the incline was anchored to a post low enough to clear the axles of the trucks, and was set one truck-length from the top of the incline. This allowed the trucks to stop just clear of the traffic while the cable was being taken off.

The excavation of the basement itself was completed in this way, after which a timber incline was erected and the earth incline removed, and the excavation of the sub-basement begun. In excavating the sub-basement the steam shovel was fitted with a long boom and a ¾-yd. clamshell bucket, which enabled it to stand near the foot of the incline at the basement level and load the trucks with material dug out of the sub-basement. The capacity of the shovel is rated at 400 yd. a day with the dipper and 300 with the bucket, but this output was not realized on account of the difficulty of getting trucks in and out of the lot. It is estimated that delays from this cause alone ran the cost of handling the material up 30 or 40c. a yd. Five-ton trucks were used, and the haul was about two miles one way over city streets.

The general contractor for the hotel is The Selden-Breck Construction Co., while the excavation work was done by The Partridge-Thomson Co.

Automatic Signals Favored in Australia

Automatic block signaling is approved on the New South Wales Government Railways, and is being introduced under two distinct conditions. On suburban lines it is used in order to shorten the headway between trains, and thus increase the traffic capacity. On country lines in districts that are thinly settled but have considerable through traffic it is found that automatic signals between stations afford improved facilities for dealing with through trains without requiring an increased force. The cost of installation and maintenance is greater than with manual signals, but there is a net saving in cost and an increase in safety due to the elimination of manual operation. Thus the 108 block sections equipped in 1916 would have required 46 signal towers, with a staff of 138 men whose wages would amount to not less than $120,000 per year. A cab-signal and train-control system is being tried experimentally on the Richmond Branch. An audible signal is given in the cab and must be acknowledged by the engineman. If he fails to stop within a given distance after receiving a "stop" signal, a partial application of the brakes is made automatically.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

No Industry To Be Classed As Non-Essential

New Manufacturing Resources Bureau Will Study Proper Control of Making of Luxuries

Walter S. Gifford, director of the Council of National Defense, has allowed it to become known in Washington that plans which were said to be on foot to make public a list of 525 industries in the United States in the relative order of their importance for the conduct of the war will not be carried out. The same information was obtained by the Washington correspondents at the office of Dr. Garfield, fuel administrator, where information in regard to the proposed order has been sought on the ground that if any industry was deemed unessential by the Government, its supply of coal would be shut off, and its name placed toward the end of the proposed list of 525 industries.

Instead of tabulating industry in classes to be known as essential and non-essential, the Council of National Defense is organizing what is to be known as a Bureau of Manufacturing Resources. The new bureau will afford a point of contact between all manufacturers and the Government, and the new bureau, as well as the Commercial Economy Board of the Council, will point out to manufacturers of what have heretofore been considered as luxuries the fact that they must expect some curtailment of their business during the war, thus opening the way for their coal and their labor to reach munition plants, etc. The plan will also give manufacturers of so-called luxuries an opportunity to convert their factories and forces wherever possible to the production of articles greatly needed for the war—the War Industries Board assisting by finding for such manufacturers Government contracts suited to their plants.

The question of imports and exports has played the principal part in the decision not to make public a list of non-essential industries, and Washington has been guided by the experience of England, when Spain refused to furnish pyrites unless Great Britain took also citrus fruits, as well as by other instances, in other countries. The Chamber of Commerce of the United States recently sent to business men all over the United States statements that it might be necessary to furnish Chile with jewelry and limousines if the United States wants nitrates and copper.

These subjects have been under consideration in Paris at the Allied conference, and it is understood that an international board, to deal with the subject of imports and exports, under which lies the question of what industries are essential or non-essential, will be created, with Oscar T. Crosby, assistant secretary of the treasury, now in Paris as a member of Colonel House's mission, as the representative on the board of the United States. It is understood that the board will continue its work during the period of the war, with headquarters in either London or Paris.

To Exempt Engineering Students from Draft

From sources of information at Washington, D. C., considered to be highly reliable, *Engineering News-Record* has learned that the War Department will soon put into effect an order exempting students in engineering schools from the army draft. While details of the plan cannot yet be definitely stated, it is believed that the cooperation of professors in the technical schools will be sought in order to determine which students shall be exempt and which shall be liable for military service. Very large powers, it is believed, will be conferred upon selected members of engineering school faculties in choosing the men to finish the technical courses. A student exempted during his college course will, however, be subject to call by the army after graduation. Students not designated by their professors as needed to complete their engineering courses, will be subject to the draft in the same way as any other individual between the prescribed age limits.

Ship Lumber Coming Fast

Five million feet of ship lumber was the production for the week ending Nov. 23. Double that amount is expected shortly, according to W. J. Haynen, assistant purchasing agent of the Emergency Fleet Corporation. A considerable number of mills in the Southern-pine industry, which have heretofore cut no ship timbers, are coming forward with offers to produce schedules or part of schedules.

Changes in Columbus Channel Plans

Changes in the plans for the river-channel widening work at Columbus, Ohio, to which reference was made in last week's issue, p. 1034, were approved by the council service committee. The concrete work on levees is reduced and the original estimate of excavation needed is revised, without decreasing the capacity of the new channel.

"Impossible! Don't Try It!" Friends Told Harris

But Man Who Is Now General Manager, U. S. Shipping Board, Built Dry-Dock in Quicksand

Rear Admiral Frederic R. Harris, Corps of Civil Engineers, United States Navy, who has been appointed by the President to succeed Rear Admiral Washington L. Capps as general manager of the Shipping Board, Emergency Fleet Corporation, is called by the Official Bulletin "a man who has succeeded in important engineering lines." The Bulletin goes on to say:

In 1910 an attempt to build a dry dock in the quicksand at the Navy Yard, New York, resulted in disaster by failure of two contractors. The condition brought about interfered seriously with the various operations at this navy yard. The abandonment of the work as impossible was seriously considered.

Admiral Harris insisted on undertaking the work, against objection that it was imposible, and volunteered to undertake the completion of the dock. Although assured by many of his friends that he was needlessly risking his professional reputation on an impossible feat, the work was completed successfully through his efforts, by employing an entirely new method of dock construction, involving the sinking of caisson foundations through the quicksand to rock.

In January, 1916, he became Chief of the Bureau of Yards and Docks, in his 41st year, the youngest bureau chief and officer holding the rank of rear admiral in the Navy, and is at the present time the youngest officer in the Navy having the rank of rear admiral of the senior half, for which permanent rank he was selected in June, 1917.

Service Board To Prepare Plans for West Side Problem

Instructions have been given by the commission to the chief engineer of the New York Public Service Commission, First District, to prepare plans for the removal from grade of the New York Central's freight tracks on the west side of Manhattan, New York City, and for the substitution of electric for steam operation. The commission holds that when the plans are made and presented at a hearing, the company can be compelled under the present law to execute the work at its own expense.

To solve other phases of the problem, however, an investigation is ordered into the validity of the permits and franchises under which the company occupies its present position.

Quebec Bridge Now in Service

The great Quebec bridge across the St. Lawrence River, affording a new through all-rail route from central Canada to the port of Halifax, is now carrying its share of war traffic to the seaboard, having been formally opened to traffic with appropriate ceremonies on Dec. 3. Officials of the Canadian Government Railways, members of the Board of Engineers and others rode across the bridge in a private car attached to the first train of freight to be moved by this route.

The design, fabrication and erection of this cantilever structure, the longest span of any kind in the world, have been described in numerous articles in *Engineering News* and *Engineering Record*. The successful raising of the central suspended span, the last important erection operation, was reported in *Engineering News-Record* of Sept. 27, p. 580.

United Society Will Welcome Civil Engineers to New Home

A meeting to welcome the American Society of Civil Engineers to its new home in the Engineering Societies Building, 29 West 39th St., New York, will be held tomorrow evening, Dec. 7, by the United Engineering Society and the three national societies, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

The announcement states that "appropriate ceremonies will signalize the association of the societies for the first time under one roof and the augmented solidarity of the engineering profession which that association promotes." The convocation, to which ladies are invited, will be held in the Engineering Societies auditorium.

The committee on ceremonies consists of E. Gybbon Spilsbury, chairman; Gano Dunn, D. S. Jacobus and William L. Saunders.

Main Is Elected President of Mechanical Engineers

Charles T. Main, of Boston, a consulting engineer who has served in several public offices for the purpose of advancing the idea of good government, has been elected president of the American Society of Mechanical Engineers, which includes in its membership 8500 mechanical engineers. Mr. Main was born in Marblehead, Mass., in 1856 and was educated at the Massachusetts Institute of Technology, from which he was graduated in 1876. Three years later, after continuous service in the Institute as assistant in the department of mechanical engineering, he became a draftsman at the Manchester Mills, Manchester, N. H., leaving this concern in 1881 to enter the employment of the Lower Pacific Mills, Lawrence, Mass., where for eleven years he acted in the respective capacities of engineer, assistant superintendent and superintendent. Since 1892 he has practiced as a consulting engineer, with offices in Boston, until 1907, being associated with F. W. Dean in the firm of Dean & Main.

Mr. Main has designed and supervised the construction of numerous industrial, steam-power and water-power plants, among his largest undertakings being the Wood Worsted and Ayer Mills in Lawrence, Mass., and four hydro-electric developments for the Montana Power Co., aggregating about 230,000 horsepower.

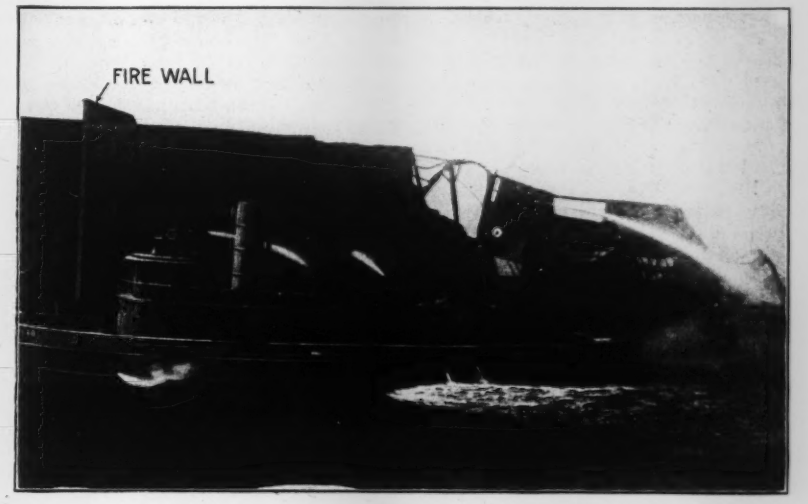
Mr. Main became a member of the American Society of Mechanical Engineers in 1885 and has served on its Board of Managers for the past three years. He is also a member of the American Society of Civil Engineers and other engineering and technical societies.

Annual Meeting of Am. Soc. C. E.

The 65th annual meeting of the American Society of Civil Engineers will be held at the new headquarters of the society, 33 West 39th St., New York, on Wednesday and Thursday, Jan. 16 and 17. The business session will take place Wednesday evening.

Fire Wall Saved Part of Pier

The accompanying view of the recent fire on Pier 8 of the Baltimore & Ohio R.R., at Baltimore, Md., shows how a reinforced-concrete fire wall projecting above the roof isolated the fire which destroyed all of the adjoining Pier 9 and the forward end of Pier 8.



FIRE KEPT FROM REAR END OF PIER BY FIRE WALL

Pier 8, completed in 1908, was built with concrete piers on piling, the piers supporting steel columns that carried the second floor and roofing. The first floor was supported on piling capped and decked at the floor line 8 ft. above the water. The steel frame was covered with corrugated iron, the roof covering being of composition slag. The floors were of heavy mill construction. The pier was divided into two sections by a reinforced-concrete fire wall projecting 4 ft. above the roof. This fire wall, in addition to affording vantage points for the firemen and tug-boats to fight and retard the progress of the flames as the fire was rapidly spreading toward the land, effectively stopped the fire and saved one-half of the pier. The fire protection consisted of 6-in. water pipe, running the whole length of the pier, with sufficient number of fire lines with hose to cover the entire area of the pier, supplemented by numerous barrels of water and buckets.

Gen. Black Asks $892,000,000 for Engineers in France

Engineer operations, including the equipment of the corps, and railroad and other construction for the expeditionary force in France will cost nearly a billion dollars in 1919. The exact estimate, made public in the annual report of Maj. Gen. William M. Black, chief of engineers, is $892,000,000, and is based on providing for the engineer operations of 1,500,000 men.

Equipment of the engineers is estimated at $135,000,000. For this work this year Congress appropriated $1,174,000, but a deficiency of $12,100,000 was incurred in outfitting the ten special railway regiments alone. One of these regiments helped stem the German assaults on the British front at Cambrai this week.

Congress provided $94,500,000 for engineer operations this year, but deficiency items totaling $186,000,000 have been submitted.

The report shows that equipment for 70 divisions, or approximately 1,000,000 men, was purchased within 350 hours after the declaration of war, including 8,700,000 articles, among them four miles of pontoon bridges.

America Must Keep Business Moving

Idea That All Activity Apart from War Is Unpatriotic Is Losing Ground—Construction Apt To Be Active—Material Prices Firm

Speculation as to how particular kinds of construction activity will be affected by the war continues to be rife, but it is all the time becoming clearer that the general volume of construction work cannot, at least, be greatly decreased. People are beginning to awake to the plain fact that the commercial and industrial development of this country must continue if we are to win the war. This aspect of the war was forcibly illustrated by Charles W. Mears of the Winton Co., in a recent address before the Cleveland Rotary Club, in which he pointed out that if America is compelled to follow the war experience of France and Great Britain with regard to her industries, it will be doubtful that the war can be won at all. France first met with the experience of being unable to fight and produce at the same time, for lack of men and materials. She called on England for financial assistance to obtain abroad the things she could not make at home. England next met the similar experience of being unable to fight and at the same time maintain the normal industrial life of the country and its tremendously important foreign commerce. So serious was the situation for these countries that there is little doubt of their inability to have carried the struggle even thus far had they been confined to their own resources. However, the markets of the world were open to them, and British credit was large. Before it was exhausted this country had entered the war on the Allies' side. This country is the reservoir from which our allies have for three years drawn the material resources with which they have carried on the war and maintained their populations, now employed almost exclusively in war industries. If this country in turn be reduced to the same basis, where could the allied coalition turn for further assistance?

War Materials Not Wealth

It is evident on a moment's reflection that a large part of the labor engaged in war industries is not producing wealth, but for all practical purposes is idle, in the economic sense that its products are wasted. It is axiomatic that wealth must be had to be taxed or to be subscribed for bonds to pay for continuing the war. Evidently, since those war industries which produce materials to be wasted are not creating wealth, they cannot of themselves support the war. There must, therefore, be sufficient goods, farm products and other commodities created by the population of this country to supply our allies and ourselves, and to produce annually sufficient wealth to stand the drain of war.

It is evident, from this point of view, that unless the business life of this country can go on largely "as usual," after the elimination of wasteful practices which have long handicapped our industrial life, ourselves and our allies will have a hard time to keep the field until a military decision can be reached. In plain words, should this country be compelled to warp its industrial life to the extent that has been necessary in France and England, and should Germany throw open the Russian Empire and organize its economic resources, this country and its allies would face defeat.

It is true that some branches of the administration have apparently failed to grasp the tremendous significance of this fact. In consequence, we see thousands of men thrown out of employment in the passenger automobile industry by the regulation of the supply of steel to their employers, without apparent provision for making use of them elsewhere. In consequence, we find the U. S. Chamber of Commerce warning the Priority Board that industries which appear to be non-essential to the conduct of war must be kept alive in order that their products may be traded for the war materials not produced in this country, in which class fall many sorts of supplies essential to the manufacture of munitions. In consequence, we narrowly escape a priority order, which, it is true, would have supplied the workman of the Northeast with coal to warm his house, but which would, at the same time, have starved him, as was shown by Mr. Hoover, and would have thrown him out of a job by making it impossible for the industry which employed him to continue business.

Nevertheless, the priority order did not go into effect; the warning of the Chamber of Commerce is generally appreciated; and there is no doubt that the situation in the automobile industry is attributable to nothing worse than a momentary lack of coördination between departments of the administration. The truth that this country must not curtail, but must actually increase its production of wealth, as distinguished from its production of materials to be wasted in prosecuting the war, is thoroughly appreciated by those in authority, and, to be put in practical effect needs only to be driven home to the general public.

Construction Expected To Be Active

Since it is granted, then, that to win the war this country must not throw away its commercial strength, but must increase it, it is hardly to be expected that we can get along during the war without construction work. Even in England construction has remained active, the remodeling and enlarging of industrial plants, the providing of accommodations for workmen, and the maintenance and improvement of roads having been found essential to the war industries themselves. How much more these things will be needed in the United States can readily be appreciated when it is understood that we must not only develop vast war industries, but that we must produce the major part of the economic wealth which is to sustain the allied coalition until the war is won.

Government demand for cement, sand and gravel, particularly on the north Atlantic seaboard, has made the supply for other work scarce. It is said that, with the increased cost of fuel and labor, the margin afforded by present cement prices is narrow, and in consequence the market is very firm.

Steel can be bought at the new prices for first-half delivery, and the quotations for reinforcing bars given this month are from mills which have the actual steel to deliver. Of course, if there is a great rush, the material will not go round; but in any event the bar situation should be much better than of late.

Other material prices are, in general, firm, with some advances, showing that, in spite of decreased building permits, general demand is holding up well for this time of year.

If Your Copy of Engineering News-Record Is Late

The offices and equipment of both the constituent units in the consolidated McGraw-Hill Publishing Co. are now under one roof. In the confusion incident to the removal of what was formerly the McGraw Publishing Co.'s plant from West 39th St. to the Hill Building, at 10th Ave. and 36th St., New York, there may be some slight delay in your receiving your copies of *Engineering News-Record*. For this we ask your indulgence, with the assurance that after readjustments have been made the combined facilities of the two big plants will leave nothing to be desired in the way of prompt and efficient service.

McKay Bequest Not Usable in Harvard-Tech Merger

The Massachusetts Supreme Court has just rendered a decision denying Harvard University the right to use the Gordon McKay fund in connection with the Harvard-Technology coöperative plan of engineering education. The court rules that the bequest must be applied to a separate scientific school. Anticipating the possibility of such a decision, Harvard has refrained from drawing upon the fund, most of which, according to the terms of the will, is not yet available, so that there will be no problem of restitution.

Road Builders' Convention

At a meeting of the directors of the American Road Builders' Association held Dec. 3, it was decided to hold the 15th annual convention of the Association in St. Louis during the early part of February. The exhibit will be small.

Testing Society Remits Dues of Soldier Members

In the November circular of the American Society for Testing Materials it was announced that the dues of members who enter the active military service of the Government, and so notify the secretary-treasurer, would be suspended during the period of such service; and that while in such service the members should retain all the privileges of membership in the society, including its publications, for which they may apply upon their return from military service.

The finance committee does not recommend any change in the dues of members entering the civil and non-active military service of the Government, for the reason that the society has always had members in these branches of the service, and the committee does not believe it would be right to treat differently those now entering the service.

Committees of the society are requested to transmit to the secretary-treasurer, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Penn., the manuscripts of their annual reports as early in the year as possible, and preferably before Mar. 1.

Will Raise Volcano Lake Levee To Protect Imperial Valley

At a recent meeting of directors of the Imperial Irrigation District, the question of flood protection work needed immediately was discussed with C. E. Grunsky and George G. Anderson, the consulting engineers for the district. In accordance with their recomendations, it was decided to make Volcano Lake levee the main line of defense and to confine protective work this season chiefly to that work.

This decision, which is not in entire accord with the recommendations of C. K. Clarke, chief engineer of the district, was made when the consulting engineers pointed out that the presence of back water in the Volcano Lake territory did not menace the valley if Volcano Lake levee was maintained in good repair, and on the contrary would be helpful in that it would deposit silt and promote the growth of vegetation, thus raising the ground level in a desirable way. Accordingly, it was decided to increase the height of Volcano Lake levee about 3 ft. and not to attempt an extension on the Ockerson levee.

Cleveland Opens Long Viaduct

The Detroit-Superior Aves. Viaduct over the Cuyahoga River, Cleveland, Ohio, was formally opened to traffic Nov. 21. The upper or vehicle deck is now in service, but the lower deck, which is to carry street cars, cannot be used until the depressed approaches and stations at the ends are completed. The bridge crosses the river by a steel arch of 591-ft. span, which is exceeded in this country only by the 977½-ft. Hell Gate arch and the 840-ft. Upper Niagara arch.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, 29 West 39th St., New York; Jan. 16 and 17, 1918, New York; Charles Warren Hunt, secretary.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS; 29 West 39th St., New York; Dec. 4-7, New York; Calvin W. Rice, secretary.

GENERAL CONTRACTORS' ASSOCIATION; 51 Chambers St., New York; Dec. 8, New York; C. A. Crane, secretary.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, 35 Nassau St., New York; Jan. 14, New York; F. A. Molitor, secretary.

NEW ENGLAND WATER-WORKS ASSOCIATION; 715 Tremont Temple, Boston; Jan. 9, Boston; Willard Kent, secretary.

AMERICAN WOOD PRESERVERS' ASSOCIATION; Baltimore, Md.; Jan. 22-24, Chicago; F. I. Angier, Baltimore & Ohio R.R., Mount Royal Station, Baltimore, Md., secretary.

CANADIAN SOCIETY OF CIVIL ENGINEERS; Montreal; Jan. 8, Montreal; Fraser S. Keith, 176 Mansfield St., Montreal, Can., secretary.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS; Dec. 27-29, Chicago; C. K. Shedd, Ames, Ia., secretary.

AMERICAN CONCRETE INSTITUTE; 27 School St., Boston; Feb. 7-9, Chicago; H. B. Alvord, secretary.

The Brooklyn Engineers' Club will meet today to hear a lecture by Edward A. Leslie on "The Economical Combustion of Oil," illustrated with lantern slides. Mr. Leslie will lay stress on the prime importance of the conservation of America's oil supply during the war and will describe a new type of oil-burning furnace, the Sklovsky method of burning liquid fuel. Mr. Leslie is connected with the General Combustion Co., Chicago. On Dec. 13 the club will hold its annual meeting for the election of officers and the transaction of other business.

The Engineers' and Architects' Association of Los Angeles, Calif., at its regular monthly meeting, Nov. 16, was addressed by Congressman H. Z. Osborne on "The First Six Months of the War." Thomas D. Allin, commissioner of public works of Pasadena, assisted by R. V. Orbison, city engineer, gave an illustrated talk on the subject of sewage-disposal plants, and James T. Barkelew, engineer and patent attorney, spoke on the subject of patents.

The Engineers' Society of Western Pennsylvania will give a smoker to its members on Dec. 7, in the English Room, Fort Pitt Hotel, Pittsburgh.

The Oregon Society of Engineers has entered into a new field of activity, that of sponsoring courses of lectures to be given in Portland by members of the faculty of the Oregon Agricultural College. Three courses will be undertaken, the subjects being "Thermics," "Engineering Mathematics" and "Structural Engineering." Each course will comprise eight lectures. These courses will not be elementary in nature, but will partake of the character of post-graduate work, designed for practicing engineers who since graduation have lost touch with the scientific progress of the world.

The Hawaiian Engineering Association at its recent annual meeting, held in Honolulu, elected the following officers: Chairman, Carl B. Andrews; vice chairman, J. A. Gibb; secretary, F. O. Boyer; treasurer, Irwin Spalding.

With a view to assisting in the food conservation movement, the **Detroit Engineering Society** dispensed with its "Feather Party," which was to have been held Nov. 26.

The Engineering Society of Buffalo, N. Y., at its electrical meeting, Nov. 21, listened to a lecture on "Electricity on the Barge Canal," by L. H. Hart. On Nov. 15 Mr. Hart delivered a lecture on "The Barge Canal" at the University of Wisconsin.

The Canadian Society of Civil Engineers will hold today the fourth meeting of the 1917-18 session, at Montreal. The speaker will be George F. Porter, engineer of construction, St. Lawrence Bridge Co., who will address the society on "The Erection of the Superstructure of the Quebec Bridge." This is the second of a series of lectures dealing with the bridge, just opened for service, and is illustrated with lantern slides.

The Nebraska Association of Members of the American Society of Civil Engineers will hold its ninth regular meeting Dec. 8, at Omaha. A feature of the meeting will be an inspection of the Minne Lusa pumping station and the sedimentation basin and laboratory at Florence, Neb., called the most modern coagulant plant in the country. In the evening there will be addresses by Andrew Jacobson, chief chemist of the station, and George T. Prince, on the operation of the station.

The Engineers' Club of Dayton, Ohio, held its first meeting of the season on Oct. 2, the lecturer of the evening being John T. Faig, professor of mechanical engineering at the University of Cincinnati, who spoke on the "Economical Use of Coal by Communities," illustrating his talk with lantern slides. The utilization of byproducts and conservation of natural resources were the main topics.

On Oct. 16, the club was addressed by its vice president, C. F. Kettering, president of the Dayton Engineering Laboratories Co., on the subject of aviation, in which a sketch was given of the history and development of the art of flying with heavier-than-air machines.

At the regular monthly meeting, Nov. 6, M. Lukeish, physicist at the Nela Research Laboratory, National

Lamp Works, of the General Electric Co., spoke on the "Art of Lighting, Its Practice and Possibilities." The latest phases in the development of artificial daylight and various color effects were described and illustrated with lantern slides and experiments.

At the midmonth meeting, Nov. 20, August Foerste, professor of geology, of Dayton, addressed the club on the subject of the geology of Dayton and its vicinity.

The Civil Engineers' Society of St. Paul at its November meeting was addressed, for the first time in its history, by a young woman. The speaker was Miss Winnifred Gregory, assistant librarian chief of the industrial arts department of the St. Paul public library, which includes the $4000 technical library, donated to the public library by the Civil Engineers Society. The title of her paper was "The Engineer and the Book." The appointment of Miss Gregory as librarian of the industrial arts department came about through the request of the society. She was librarian of the school of mines library, University of Minnesota, for four years.

PERSONAL NOTES

WARREN R. NEEL has been appointed chief engineer of the State Highway Department of Georgia. Mr. Neel is a graduate of the Georgia School of Technology, and has been identified with large engineering enterprises, especially in Mexico, in which country he was connected with the engineering and construction of the Mexican National highway. In the administration of his department Mr. Neel will be assisted by H. E. ANCHUTZ, formerly with the Florida Highway Department, and J. W. BOYD and E. DAVIS.

JOHN M. MALLOY, of Davenport, Ia., county engineer of Scott County, is now a second lieutenant in the National Army at Fort Snelling.

F. C. CLARK has left the position of superintendent of the New Castle Construction Co., New Castle, Del., to accept the position of superintendent of the Kenilworth plant of the American Can Co., at Kenilworth, New Jersey.

S. F. BLOYER has left his position as draftsman with the Cumberland Valley R.R. Co., and is now in the engineering department of the H. Koppers Co. of Pittsburgh. He is now at Steelton, Penn., where the company is constructing a byproduct coke oven plant for the Bethlehem Steel Company.

ROBERT E. WISE has resigned the position of designing engineer with the Board of Water Commissioners of the City of Hartford, Conn., to accept a similar position with the Connecticut River Conservation Co., at Turners Falls, Massachusetts.

KASTENHUBER & ANDERSON will close there office at Easton, Md., on Jan. 1, for the period of the war. Both members of the firm have entered the army, E. G. KASTENHUBER, JR., as first lieutenant in the Sanitary Corps, and JOHN ANDERSON as sergeant, Battery C, 310th Field Artillery.

PHILIP BRUTON, formerly superintendent of reclamation and irrigation work in San Joaquin Valley, California, with C. E. Grunsky, consulting engineer, San Francisco, is now a lieutenant in the Construction Division of the Aviation Corps, National Army, and is stationed at Vancouver Barracks, Vancouver, Washington.

FRANK LEE, engineer maintenance-of-way of the Canadian Pacific Ry., with headquarters at Winnipeg, has been transferred to Montreal, exchanging places with A. C. MACKENZIE.

RUSSELL A. TRUFANT, formerly with Hartley L. White, Braintree, Mass., is now office engineer for the Cameron County Water Improvement District No. 2, San Benito, Texas.

J. H. A. BRAHTZ has been retained as consulting engineer for the proposed bridge across the Zumbro River to replace the bridge near the power dam, to be built by the City of Rochester, Minnesota.

ERICH A. ZACK, formerly assistant city engineer of Beloit, Wis., is now connected with the Iowa Highway Commission as assistant engineer and chief inspector on the Camp Dodge cantonment road.

GEORGE W. HAWLEY, for the past four years assistant engineer, South San Joaquin Irrigation District, California, is now engineer in charge of San Pablo project for the East Bay Water Co., Oakland, California.

E. B. TOURTELLOT, county engineer of Clayton County, Iowa, for the past four years, is now maintenance engineer, North Dakota State Highway Commission.

WILLIAM B. MCCALEB, formerly superintendent of the Philadelphia division of the Pennsylvania R.R., has been appointed general superintendent of water companies, with headquarters at Philadelphia. Mr. McCaleb entered the service of the Pennsylvania R.R. in March, 1880, as chainman with an engineer corps at Connellsville, Penn. He became superintendent of the Sunbury and Shamokin division in 1896; in May, 1902, he was promoted to superintendent of the middle division at Harrisburg, and in June, 1903, be became superintendent of the Philadelphia division.

A. W. THOMPSON, vice president of the Baltimore & Ohio R.R., and formerly chief engineer, has been appointed chairman of the operating committee of the Railroad War Board, which will coördinate the thirty-eight important railways in the Eastern group of the United States into one single system. This system comprises 122,000 miles of track. Its operating revenue for the twelve months ended June 30 was $1,750,000,000.

GEORGE B. DUSINBERRE has resigned as water commissioner of the city of Cleveland, Ohio. He will continue his work as an engineer.

W. G. READ, formerly assistant engineer, has been made engineer of the Kansas Public Utilities Commission, at Topeka, in place of CAPT. T. J. STRICKLER, who is at present at the Engineer Officers' Training Camp at Ft. Leavenworth, Kansas.

W. L. BENHAM, of the Benham Engineering Co., Oklahoma City, has been commissioned major in the Quartermaster's Department, Camp Funston.

R. B. LEE has been made city engineer of Hutchinson, Kan., vice CAPT. G. L. MCLANE, regimental adjutant of the 110th Engineers at Camp Doniphan, Oklahoma.

V. L. LOGAN, who was formerly assistant city engineer of Hutchinson, Kan., is now sergeant in Company A, 110th Engineers at Camp Doniphan, Oklahoma.

MATT GRAHAM, for six years with Black & Veatch, consulting engineers, and later with the Western Brick Manufacturers' Assn., has been made city manager and engineer of Augusta, Kansas.

BERT C. WELLS, for eight years city engineer of Wichita, Kan., has been appointed city manager of Eldorado, Kan. His place as city engineer of Wichita is taken by P. F. BROCKWAY, formerly assistant city engineer.

NORMAN F. STRACHAN, assistant engineer, Kansas State Board of Health, has resigned and is now serving in the ranks of the 23rd Engineers (Highway Regiment) at Camp Meade, Maryland.

ANDREW GROFT, formerly engineer for the American Cement Plaster Co., is now in the 23rd Engineers (Highway Regiment) at Camp Meade, Maryland.

F. M. VEATCH, formerly chief chemist, East St. Louis Water Co., East St. Louis, Ill., has been appointed assistant engineer of the Kansas State Board of Health, succeeding ALBERT H. JEWELL, who resigned to become assistant engineer for the Michigan State Board of Health.

GEORGE A. ARMES, chief engineer of the Union Iron Works, has been appointed assistant district officer of the Western division of the U. S. Shipping Board at San Francisco.

GALEN B. OWEN, promoted from the office of superintendent of maintenance of the Erie R.R., with headquarters at New York, to that of chief engineer of the Erie R.R. and the New York, Susquehanna & Western R.R., has been connected with the Erie since April, 1903, when he was appointed assistant to the general manager.

There was a break in his service with the road from 1913 to December, 1916, however, when he was engaged in other than railroad work. Before his connection with the Erie, Mr. Owen was successively rodman, assistant engineer, roadmaster and engineer of construction on the Lehigh Valley R.R. From August, 1896, to July, 1902, he was division engineer and superintendent, maintenance-of-way, on the Baltimore & Ohio R.R., and from July, 1902, to April, 1903, engineer, maintenance-of-way, of the West Virginia Central & Pittsburgh R.R., now a part of the Western Maryland. Mr. Owen was born July 31, 1860, and was educated in Towanda, Penn., at the high school and institute.

J. McCREADY, municipal engineer of North Vancouver, B. C., recently tendered his resignation to the City Council.

NEIL COVENTRY has been appointed city engineer of Harrison, Idaho.

J. S. LONG, of the Long Building Co., Seattle, Wash., has taken charge of the construction of the Y. M. C. A. construction work at Camp Lewis, American Lake, Washington.

H. D. BARNES, until recently employed by the Chicago & Northwestern Ry. as inspector on bridge concrete work on the lines west of the Missouri River, is now in the maintenance department, Black Hills division.

CAPT. H. S. BAKER, constructing quartermaster, Camp Bowie, Fort Worth, Tex., has received a commission as lieutenant colonel of engineers in the National Army. He is principal assistant city engineer of Chicago, on furlough. His previous military experience was as first lieutenant with the National Guard in Texas in 1916.

W. R. SIDES, until recently assistant to the contract manager, Turner Construction Co., New York, is now assistant to the president of William Whitman & Co., cotton manufacturers, Boston.

F. H. DODDRIDGE, who has been employed in the United States Engineer's Office, Cleveland, Ohio, for the past three years, on river and harbor improvements, has been transferred to Washington, D. C., as field engineer on the new Key bridge across the Pomotac River.

MAJ. G. W. FREEMAN, of the Engineers' Reserve, has been made head of the St. Paul, Minn., engineering district, succeeding D. W. LOCKWOOD, of Duluth. Major Freeman was assistant engineer in the St. Paul district from 1906 to August, 1917.

R. C. YEOMAN, dean of engineering, Valparaiso University, Indianapolis, has been made associate professor of highway engineering at Purdue University. He was graduated from Purdue in 1907 and was with the National Bridge Co., the Pennsylvania R.R. and Southern Indiana Traction Co. before going to Valparaiso in 1909. Professor Theroux will assume his duties.

MAJ. DABNEY H. MAURY, Engineer Officers' Reserve Corps, has closed his office in Chicago for the duration of the war. For some time past he has been in Washington looking after water-supply problems in connection with cantonment construction.

W. I. JOHNSON, formerly at Butte, Mont., as superintendent for the Foundation Co., concrete lining the Granite Mountain Shaft for the North Butte Mining Co., is now superintendent of construction for the Foundation Co. at the League Island Navy Yard, Philadelphia.

FRED B. GREENLEAF, until recently in charge of the construction of a barking plant for the Great Northern Paper Co., at Millinocket, Maine, has returned to Auburn, Maine.

HARRY W. BELL, until recently with the H. Koppers Co., of Pittsburgh, is now with the Bridge Department of the Interstate Commerce Commission, Southern District, at Chattanooga, Tennessee.

HENRY C. SHELDON, formerly with the Gifford-Wood Co., of Hudson, N. Y., is now with the Wellman-Seaver-Morgan Co., Cleveland, Ohio.

T. J. MADLEN, who was superintendent for the Cooper-Widenmann Construction Co., Detroit, is now with the Masters & Mullen Co., Cleveland, Ohio, as superintendent of construction.

GEORGE R. ARCHIBALD, for the past eight years Carey Act inspector for the Salt Lake Division of the field service, United States Land Office, has resigned to take up the practice of consulting irrigation engineer, with headquarters at Jordan Valley City, Oregon.

C. M. OSBORN, for ten years city engineer of Lorain, Ohio, has been appointed first city manager of East Cleveland, Ohio. Mr. Osborn is a graduate of Case School of Applied Science. He will enter upon his new duties Jan. 1.

J. WARREN JONES, resident engineer in charge of the St. Louis office of the Phoenix Bridge Co. and the Phoenix Iron Co., has been appointed office engineer to assist in the Division of Shipyard Plants of the Emergency Fleet Corporation, Washington, District of Columbia.

HERBERT M. HALE, until recently with the Holbrook, Cabot & Rollins Corporation on Catskill Aqueduct and New York subway work, has gone to the Turner Construction Co., New York, as assistant to the contract manager. Mr. Hale had been with the Holbrook company for six years, prior to which he was with the New York Rapid Transit Commission and the New York Board of Water-Supply.

ROBERT S. PARSONS has been made assistant to the president and general manager of the Erie R.R. and the New York, Susquehanna & Western R.R. He has been assistant to the president and chief engineer of the Erie R.R. at New York. Mr. Parsons will remain in charge of maintenance and construction, with headquarters in New York. He has been with the Erie R.R. since 1895.

OBITUARY

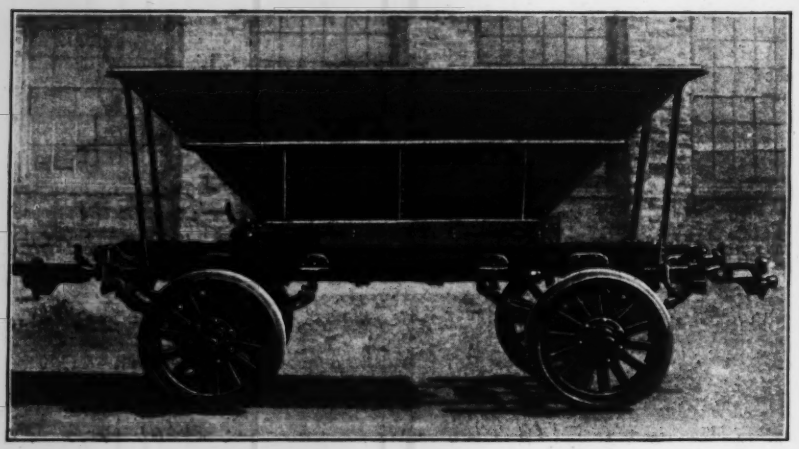
JOHN J. SHEAHAN, owner of the Sheahan Construction Co., of Roanoke, Va., died at Rochester, Penn., Nov. 19. Mr. Sheahan was engaged in railroad construction work in the Southern and Middle States. He was at one time machinist and engineer on the Chicago Drainage Canal and also master mechanic in Richmond, Va., in the course of the construction of the canal and the power house in that city. He was born in Frederick County, Virginia, 53 years ago. One of his brothers is Thomas Sheahan, railroad general contractor, Hagerstown, Maryland.

HARVEY C. MILLER, chief engineer of the International Railway Corporation, died in Newark, N. J., Nov. 23, in his 56th year. Mr. Miller began work as an axeman on the South Florida R.R. in 1879. He left Florida in 1887, when he became connected with the Nicaragua Canal Construction Co., with which he remained until 1893, engaged in railroad location and construction work, and also canal surveys and location. Later he went to the Guatemala Northern Ry., returning to Nicaragua in November, 1897, and remaining until February, 1899, as principal assistant engineer to the chief engineer of the Nicaragua Canal Commission for the United States Government. Mr. Miller was connected also at one time with the Hastings Paving Co., on work in Brazil. He returned recently from Santo Domingo, where he was engaged in overseeing construction of concrete viaducts for the Dominican Government.

ALEXANDER Y. BAYNE, president of the Minneapolis Bridge Co., died Nov. 31 in Minneapolis. Mr. Bayne was 62 years old and had lived in Minneapolis since 1880. Besides being engaged in bridge building he was president of the Queen of the West Mines company.

CAPT. ASA ROGERS died at his home in Petersburg, Va., on Nov. 27, in the 83rd year of his age. He was a Civil War veteran, serving in the Confederate Army as a captain of cavalry. After the war Captain Rogers resumed the practice of his profession as a civil engineer, being associated with the late Gen. William Mahone, assisting him in the rehabilitation of what is now the Norfolk & Western Ry. system. He was one of the engineers who built the famous long bridge near Farmville, Va. Captain Rogers was active in politics

and at the time of his death was employed as a deputy United States marshal.



TRAILER FOR ROAD WORK HAS BOTTOM DUMP

BUSINESS NEWS

Hamilton Now with Walworth

L. F. Hamilton, until recently manager of the advertising and specialty department of the National Tube Co., Pittsburgh, assumed approximately similar duties with the Walworth Manufacturing Co., Boston, Dec. 1. The Walworth company purchased the Kewanee works of the National Tube Co., Aug. 1. Mr. Hamilton has been identified with the exploitation of "Kewanee" products since 1908. His place in the National Tube Co.'s organization has been taken by W. L. Schaeffer, formerly assistant to Mr. Hamilton.

APPLIANCES AND MATERIALS

Truck Trail Wagon Has Bottom Dump

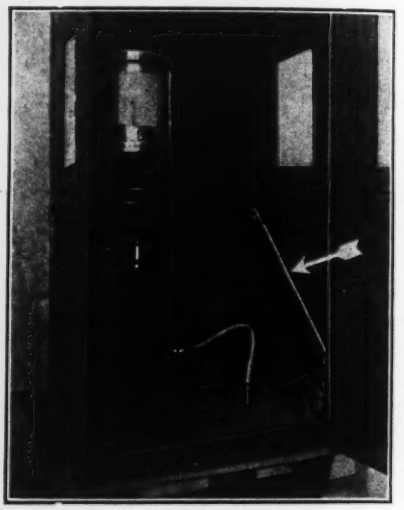
Controllable gravity discharge through bottom doors is the feature of the auto-trailer shown in the accompanying view, and recently introduced by the Warner Manufacturing Co., of Beloit, Wis. The 4-yd. steel hopper body is mounted on a 5-ton frame, and the weight of machine empty is about 1590 lb. The wagon was designed specially for road construction, and has the doors controlled by a ratchet device, so that the load can be spread as desired, while at the same time it is kept clear of the wheels.

The frame is 56 x 46 in., and the track of the wheels is 56 in. The axles are of alloy steel with roller bearings and Sheldon hub. The wood wheels are of the artillery type and have solid 4-in. rubber tires 36 in. in diameter. Semi-elliptic plate springs are used, 48 in. track with those of the leading vehicle. This device was described in *Engineering News* of Mar. 15, 1917. The length of drawbar from center of axle to hitch attachment is 7 ft., with adjustments which permit of increasing the length to 10½ ft. or 14 ft.

Jacketed Electric Heater Unit

The steel-jacketed electric heater unit shown in the accompanying illustrations has been put to innumerable uses in all kinds of industrial plants. Besides such applications as in crane cabs and valve, pump and meter houses, there have been scores of miscellaneous applications. The ease of conducting electric current to remote corners, to moving crane cabs, etc., make the use of an electric heat simpler than that of any other. The heater units shown are of 500-watts capacity, can be connected up in multiple to any A.C. or D.C. circuit where the voltage is not in excess of 250 volts. Only as many as are actually required need be installed, yet additions can be made easily as adding electric lamps. Just as lamps are placed singly or in groups in locations where light is required, so also are these units mounted singly or in groups in locations where heat is required.

The units are flat, the dimensions being 3/16 in. x 1½ in. x 23¾ in. All parts are inclosed and no porcelain, cement asbestos or molded insulation material is used. Insulated eyelet holes permit the use of ordinary screws for mounting—terminal connectors being placed at each end. In mounting, space is provided between units and between the unit and the surface on which it is mounted to allow for a good circulation of air. The installation view shows one of these C-H units installed in the gas valve house in the coke plant of the



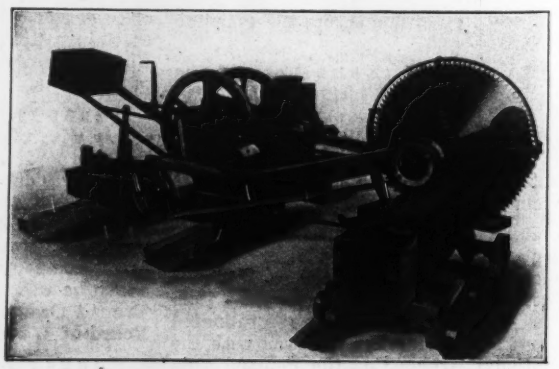
EASILY INSTALLED AND OCCUPIES BUT LITTLE SPACE

Corrigan-McKinney Co., Cleveland. These units are designed and manufactured at the New York works of the Cutler-Hammer Manufacturing Co., Milwaukee.

Portable Crosscut Saw Is Driven by Gas Engine

A new portable heavy-duty crosscut saw has been put on the market by the C. H. & E. Manufacturing Co., Milwaukee. Driven by a 10-hp. gasoline engine it has cut through a 12 x 12-in. timber in 6 seconds, and can handle sticks up to 16 in. square.

As the photograph reproduced at the right of this article shows, the saw itself is well guarded to prevent accidents, and is counter-balanced, the operation being through the pinion and quadrant. The wooden lever in the rear of the frame operates a clutch through which is driven the bevel pinion, which engages lightly with the timber as it rests on the carriage. Through this pinion the timber is moved back and forward to the point where the cutoff is desired.



CUTS THROUGH 12 x 12-INCH TIMBER IN SIX SECONDS